

AUTOMOTIVE INDUSTRIES

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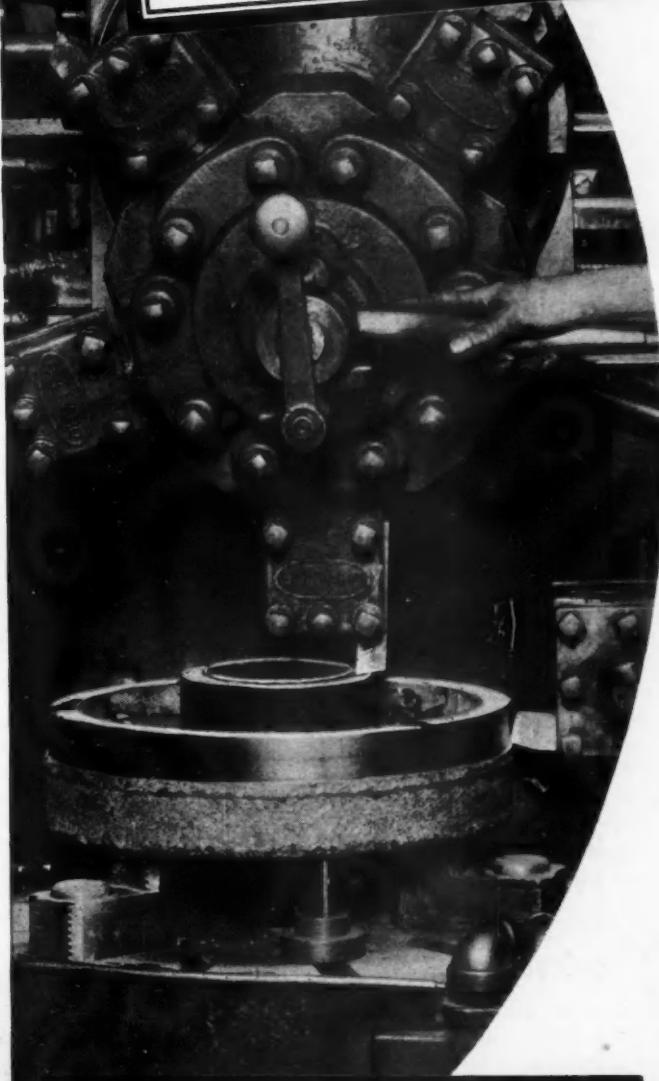
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AUTOMOTIVE INDUSTRIES

Vol. 72, No. 12

THIRTY-SEVENTH YEAR

March 23, 1935

First 1935 Million Off Lines

Continued Retail Demand Indicates 425,000 in March

Labor High Spots

Green writes car and parts makers individually requesting bargaining conferences.

* * *
F. J. Dillon, A. F. of L. organizer in Detroit, gets invitation to speak before bargaining agency created by ALB elections at Dodge truck plant.

* * *
A. F. of L. puts five more organizers in Detroit and inaugurates educational campaign.

* * *
A. F. of L. campaigns for votes at ALB elections held at Fort Wayne IHC plant, representing its first public participation in these elections. More than 30 per cent of workers at this plant and at Chrysler Newcastle plant vote A. F. of L. affiliation, a record for the Federation in ALB elections.

* * *
Matthew Smith, head of MESA, accepts nomination to bargaining agency in Saginaw Chevrolet foundry. Heretofore MESA has declined to participate.

by Harold Gronseth

Detroit News Editor, Automotive Industries

The motor industry this week completed the first million vehicles of its 1935 output which leading executives now estimate easily will reach 3,500,000 units by the close of the year. The million mark was not attained last year until well into April, and in 1933 it was almost mid-year before production had reached that point. In the lean year of 1932 the industry did not cross the million mark until the last week of July.

The retail market which has not yet felt the full force of seasonal expansion in demand warrants continuation of the current high production rate which indicates that the earlier projection of 425,000 cars and trucks for March will be met. The first quarter of 1935 will close with an output of around

1,085,000 vehicles, which compares with 749,532 units turned out in corresponding period of 1934. Strength of the retail market has surprised sales executives, some of whom feel that retail business is better than it has a right to be, and have their fingers crossed for the future. However, there is currently no cloud on the horizon, and some of the best minds foresee good business until June. Special efforts are being made through campaigns and dealer meetings to prolong the peak season until the summer months, as in 1934 when domestic retail sales of passenger cars were maintained with comparatively little variation on a basis which averaged 223,000 cars a month for four months, from April to July, inclusive. The peak for the year was reached in July, 1934, when new car registrations totaled 229,864. While some dealer organizations are well stocked and fully prepared for whatever expansion takes place in retail demand others are not so well off and unless there is a slowing down of demand some will not be caught up until June. With few exceptions, however, April production will be tuned pretty closely to the sales rate.

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Green Asks Employers Individually for Hearing; AFL Campaigns for ALB Votes

DETROIT, March 20—All is quiet on the automobile labor front. Whether or not this is only a lull before the storm will not be known until the A. F. of L. takes action on replies to letters sent out Monday by William Green to all employers in the automobile and parts industries, requesting conferences.

Union headquarters in Detroit declined to disclose the text of Mr. Green's letters until the employers have had time to reply. Observers were of the opinion that the employers would reply individually and probably arrange conferences. This would be in line with their general policy in the past of not refusing to confer with anyone who could show that they represented the workers. In other words such procedure would be consistent with the policy of proportional representation advocated by the manufacturers. It is expected that the larger companies will refer the request for conference to the executive heads of their various plants.

F. J. Dillon, general organizer for the motor industry, returned from Akron where he addressed union workers in the rubber industry with the assurance that the A. F. of L. membership there would support the Federation's drive for recognition by the motor industry. Mr. Dillon also found encouragement in an invitation to address workers in the Dodge truck plant. The invitation came from the bargaining agency set up by the Wolman Board.

The A. F. of L. has intensified efforts to bolster its membership in the motor industry by the addition during the past week of five new organizers in the Detroit district. At the same time, the Workers' Education Bureau of the A. F. of L. has opened an office in Detroit which, according to its director, Paul L. Vogt, is "in response to the increasing need for the training of officers and members of organized labor resulting from the present industrial situation." It is a part of a nation-wide program instituted by the A. F. of L. and represents, according to Detroit labor offi-

(Turn to page 408, please)

New LaSalle Priced Lower

	1935	1934
2-pass. coupe	\$1,225	\$1,595
Convertible coupe	1,325	1,695
2-dr. Sedan (touring)....	1,255	1,695
4-dr. Sedan (touring)....	1,295	1,695
4-dr. Club sedan .....	...	1,695

Car Makers Refute Richberg-Barkley Allegations of Freight Chiselling

WASHINGTON.—Time out was taken to rap the automotive industry's pricing system by members of the Senate Finance Committee last week when some of them were kicking the old political football, the steel basing point system. They were buzzing Donald R. Richberg about the latter which again has become a sizzling subject as the result of the conflicting reports of the Federal Trade Commission and the National Industrial Recovery Administration.

Senator Barkley, Democrat, of Kentucky, asked Mr. Richberg about the practice of the automotive industry in quoting f. o. b. Detroit prices even though cars are carried "all over the country by truck loads at infinitely lower cost than would be charged by freight, so that the purchaser is paying for the car as if it were carried by freight."

Mr. Richberg said the Senator's statement was true. Moreover, Mr. Richberg said that it is also true that cars are assembled "or have been under previous practice, which I assume is still going on, at others points, but the charge regardless is made f. o. b. Detroit plus freight."

Mr. Richberg proceeded to add that the purchaser of the car is being charged in many instances the same artificial freight so-called that has been charged in effect against the basing point system in the steel industry.

Mr. Richberg, administration member on the steel code, told the committee that NRA has been insisting that where there was an unfair transportation charge in the steel industry that complaints should be made for an allowance in transportation charges.

"For example," said Mr. Richberg, "the automobile industry, a large consumer of steel, insisted upon having allowances made

in transportation charges to Detroit and in the interest of a competitive situation, to bring the plants at a distance from Detroit into competition with the plants nearer, those allowances are made."

* * *

DETROIT.—Whatever profit is made by motor companies on excess freight charges included in the delivered price of cars is passed on to car buyers in the form of lower factory prices. Competition sees to that, said motor executives commenting on Senator Barkley's attack on the industry's method of collecting transportation costs on new vehicles, in the administration's investigation of the steel industry's basing point system. The assertions made at this hearing showed lack of understanding both of the industry's price policy and the motor vehicle retailing code, it was stated.

The retail code provides that charges for freight included in the delivered price of a car must be the actual freight costs determined on basis of the average cost over sixty-day periods, including all forms of transportation, highway, water route or rail. Hence unless the code is violated there is

no profit to the dealer, much less to the manufacturer, from the use of means of transportation that cost less than all-rail.

Prior to adoption of the retail code, dealers did enjoy an advantage in utilizing the lowest cost form of transporting new vehicles from the factory but even then the savings generally were passed on to the buyer usually in the form of higher allowance for the used car taken in trade. It was at the insistence of the consumer, at the code hearings, that the "actual cost provision" was written into the code.

The proportion of the industry's output going out to dealers by rail has been increasing in recent years as result of the diminishing differential between rail and trucking costs brought about by actual reduction in rail rates and by the utilization of permanent loading devices in auto-

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FWD Names Pinkowsky New Purchasing Agent

Lloyd J. Pinkowsky has been made purchasing agent for the Four Wheel Drive Auto Co., Clintonville, Wis., to fill the vacancy created by the sudden death of Guy H. Billings. Mr. Billings was also assistant general manager of the Four Wheel Drive Co. Mr. Pinkowsky became associated with the FWD Company in 1924.

Reshape Eastman Truck Regulation Bill Into Measure Acceptable to Operators

Work of reshaping the Eastman bill for regulation of the trucking industry into a measure acceptable to the industry following the battering to which it was subjected at Congressional committee hearings has begun.

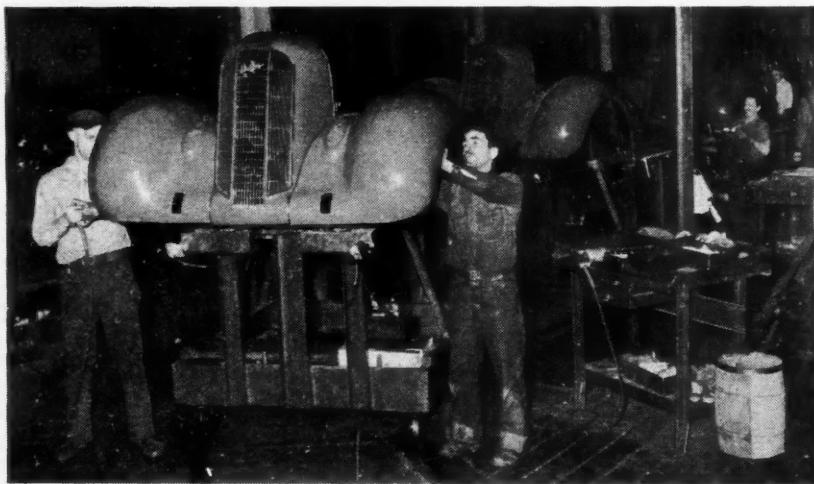
At a recent meeting with Coordinator Eastman and his staff, representatives of the ATA made several suggestions which met

with approval of the bill's author and his aides. The measure was gone over thoroughly and the suggested changes followed the lines of the general program of ATA's policy committee. One of the principal points discussed, according to ATA spokesmen, was the inclusion in the bill of the trucking code provisions as a means of securing enforcement of the law and making it readily adaptable to the general characteristics of the industry. Mr. Eastman is said to have been favorably disposed toward the contention of the ATA representatives that organization of the industry is a prime prerequisite to effective regulation.

It has been reported that the Coordinator, as well as members of Congressional committees, realize the size of the regulation problem because of the fact that 85 per cent of the industry is composed of one-truck operators. Lacking this factor, it has been pointed out, regulation would be comparatively simple, but that 85 per cent constitutes an important competitive problem and must be given cognizance in any type of federal regulation.

Some regulation advocates, it is said, cling to the idea that trucking operations could be consolidated into sizeable concerns. However, there is considerable doubt from facts presented at ATA hearings whether the "little fellow" can be easily eliminated inasmuch as he has always performed a useful local service.

Another advocated revision would deny to operators who had not complied with their respective codes the privilege granted under the "grandfather" clause. Present indications are that preference will be given under regulatory bills to those operators who have proved themselves to be law-abiding and who have supported the NRA.



Pontiac builds up the sheet metal sub-assembly, radiators, front fenders, running boards, etc., on the mezzanine directly above the assembly line. The main line arches up into the mezzanine with sufficient dwell to permit the mounting of this assembly. The arrangement helps to clean up assembly stations at the main line.

FHA \$100 to \$2000 Loans Available for Garage, Service Equipment Purchase

Cash loans ranging from \$100 to \$2000, repayable in instalments over an extended period, may be obtained under the Federal Housing Act by automotive maintenance establishments for the purchase of permanently installed garage and service equipment, according to a bulletin of the Motor and Equipment Manufacturers Association. The money is obtained from local banks and financial institutions in the same manner as home modernization loans which the Federal Housing Authority is promoting so actively.

In the interests of members of the MEMA, MEWA and NSPA a list of equipment has been presented to FHA for a ruling as to its eligibility under the permanency requirement. Prompt action is expected on this list and in its approved form it will be transmitted to all cooperating banks and to field FHA offices so eligibility questions can be settled quickly when loan applications are made.

Apparently FHA policy is to interpret "permanent" as used in the Act very broadly; in fact the bulletin says the tendency is to lean backward. At any rate, the MEMA says, "Any piece of equipment which is bolted to the floor, walls, or ceilings, or which is permanently attached to electric, air, gas, water, or oil systems is considered to be 'permanently installed' under the Act. Electrically operated equipment which usually is 'plugged in' can be permanently installed by running the leads through conduits or by sealing the connection with solder. We have been advised that equipment which is portable within the shop, such as test benches on wheels or casters, but which is permanently connected with its source of power, as indicated above would qualify."

In promoting the use of FHA loans, the MEMA advises manufacturers to recommend to jobbers that they concentrate on the upper 20 per cent of their customers from a credit standpoint since experience in a comparable industry indicates that only one dealer in five can qualify as a risk. If this policy is necessary, some jobbers feel that the plan will have only very limited application since they contend that they are having no difficulty in providing whatever credit the upper 20 per cent of their customer's need.

Any maintenance establishment is eligible for a loan provided it owns the property it uses or has a lease running six months or longer. The loans may run up to three years, but the duration of the credit is for the bank providing the money to decide. The annual gross income of the signers of the notes must be at least five times the annual payments.

Cedarburg Making Light, 2 h.p. Outboard Motor

Cedarburg Mfg. Co., manufacturing electric motors, stampings, etc., at Cedarburg, Wis., has entered quantity production of a new type of outboard engine much lighter than the conventional type, more compact and selling for a substantially lower price. It is built chiefly of light alloy steels instead of aluminum and consists of only 31 parts.

It develops 2 hp. and will propel an ordinary rowboat at a maximum speed of 6 m.p.h. No carburetor is used, a patented mixing valve having been developed. It is designed to appeal mainly to week-end sportsmen and fits into the average automobile trunk. The Cedarburg concern was purchased about two years ago by Thorvald Hansen, who was for many years a production executive with A. O. Smith Corp.

New Models Consume One-third More Steel

Producers Unfavorable to FTC Base Point Plan Prefer Present Basis

Although automotive demand is holding its own rather than showing further gains, it continues to be the backbone of the steel market. Not a little of the heavier steel tonnage absorbed by automotive consumers results from the increased amount of steel that goes into each new model unit, it is generally assumed that 1935 change in design added one-third to the steel consumption.

Sheet mills continue to make the best showing in point of backlogs, body-builders having been consistent in anticipating their requirements over the next two months to guard against delays in sheet shipments. Strip mills have a fair run of automotive business. Automotive alloy steel specialists continue to operate at a satisfactory rate. While demand from other classes of buyers of cold-finished bars and wire products is disappointing, that from automotive consumers is well maintained. The same holds true of bolts and nuts.

While it is claimed in the market that the Federal Trade Commission's report on the basing point system is the cause

of much hesitancy on the part of buyers, automotive commitments, nearly always accompanied by shipping orders, have hardly been affected by this development. Steel producers appear to be unanimous in their advocacy of the present system of basing point. Little has been heard on the subject by way of comment from representative steel buyers. The principal argument heard in favor of the continuance of the present system is that it works, while the NRA proposal to set up a group of mill bases, each with a fifty-mile radius, is looked upon as more or less of a hazardous experiment and the Federal Trade Commission's espousal of f. o. b. mill prices, if it were adopted, as nothing short of catastrophe.

Pig Iron—Automotive foundries continue to make up the front ranks of pig iron buyers. There is nothing spectacular about their purchases, but they are taking in fair-sized tonnages, although in some cases they make more bites of a cherry than sellers consider necessary. The market's price structure is unchanged.

Aluminum—The market is more or less of a routine character. Prices for virgin metal are unchanged. More activity on the part of automobile wreckers is providing a better supply of scrap to secondary refiners.

Copper—Domestic demand is fair. Under the influence of reports that the international conference of producers is approaching agreement on export quotas, foreign markets have advanced. This may eventually, although not in the immediate future, furnish solid support to the "Blue Eagle" price of 9 cents, which continues unchanged.

Tin—International developments served to depress the tin market. Spot Straits sold early in the week at 46 cents, more than a full cent lower than the preceding week's closing price.

Lead—The leading interest advanced the contract price \$1 per ton on Monday, other marketers following suit. The New York price is 3.60 @ 3.65 cents.

Zinc—Firmer.

Dealer's Recovery Bill Proposed in Maryland

A State Industrial Recovery bill limited to the motor vehicle retailing trade has been introduced in the Maryland legislature. The bill in general is patterned after the dealer's NRA code and its passage would make that code part of the laws of the State.



More than 20 gray-haired Dodge Bros. veterans greeted the 3 millionth Dodge as it came recently from the assembly line. Four of the group who piloted the first car from the lines drove and rode in this one as it rolled into the factory yard.

Steel Code Revisions to Give Lowest Possible Prices Urged by Car Makers

DETROIT.—Car manufacturers are a unit in believing that modifications should be made in the present steel pricing system and in the steel code to give them advantages to which they feel that they are entitled because of their position as the country's largest steel consumers and because of their proximity to mills in the Detroit district.

Practically all Detroit motor car companies and parts makers think that Detroit base prices should be established on all steel products made in the metropolitan Detroit area. They have advocated such a plan for several years, which would eliminate the present set-up of paying a freight rate from Pittsburgh to Detroit on steel rolled at Detroit and trucked a few miles to their plants.

Critically examining the reports of both the Federal Trade Commission and the NRA committee, which differ radically in their recommendations of what should be done about pricing steel products, the automobile industry concludes that it is not committed definitely to any one plan. It wants just one thing—the lowest possible delivered prices for steel which goes into automobiles. In order to attain this objective, the industry feels that changes must be made in the steel code as well as in the basing point system for selling steel.

The automobile manufacturing code differs radically from the steel code. It makes no attempt to set prices or restrict in any way free and open competition. Every car manufacturer must stand on his own feet without support from artificial code props.

In contrast to this encouragement of unrestrained competition in the car manufacturing industry, say automotive executives, are the provisions in the steel code which seek to "hold an umbrella" over the steel mills disadvantageously located or having older type equipment which makes production more costly than with modern mills. Undoubtedly Alfred Reeves, vice-president of the Automobile Manufacturers' Association, had reference to the steel code, among others, when he addressed a communication to NIRA early in January saying that car manufacturers "have asked me to record with you their opposition to the continuation of trade practice provisions in any code of fair competition where the direct or indirect objective is price-fixing, price maintenance or production control."

Automobile companies continue to object strenuously to the inflexibility of the steel code which prevents them from being given preferential price treatment because of their large tonnage. Even though they place thousands of tons with a steel mill, they must pay the same price as the small consumer which buys 10 tons. Before NRA they got a concession of \$2 to \$5 a ton because of their buying power.

Not the least of the concern of automotive purchasing departments has been over the sharp increase in steel prices since the

steel code was adopted. These increases range from \$10 to \$15 a ton. Since the average car contains a ton or more of steel, higher steel costs have been of major importance to the automobile industry. What with boosts in materials, parts and labor costs, the margins on which car manufacturers are operating are perhaps the lowest in history and, outside of the three leading companies, the industry has been losing money.

A prominent automobile company has long taken the position that it is selling steel to the public and that the higher the price it must pay for that commodity, the more it must charge its customers and hence restrict instead of expand its markets. It believes that every steel company should take its chance in a free and open market just as every automobile maker is doing today.

Establishment of Detroit as a basing point for steel products made in the Detroit district would benefit such companies as Ford, Chrysler, Packard, Cadillac and the gear and axle division of the Chevrolet Motor Co. On the other hand, General Motors plants outside Detroit would be at a greater disadvantage than they are today compared with Detroit plants. Their freight rates from Detroit would be \$2.50 to \$3 a ton more than the present differential, which is about \$1. Similarly, parts companies in Jackson, Lansing, Flint and other southern Michigan cities would be handicapped in their competition with Detroit rivals because of the increased cost of steel laid down in their plants.

Ford, which is now completing erection of a continuous sheet mill at Dearborn because of objectionable conditions growing out of steel code, assumes a somewhat indifferent attitude toward whatever might happen to the present steel price structure. However, it has a direct interest in that it will have to buy large quantities of steel outside, even though operating its new mill at capacity, whenever its production gets anywhere near the present level of 6000 cars a day. In fact, Ford's expanded steel facilities will enable it to take care of a car output of only about 3300 units a day without resort to outside steel purchases.

Detroit the last week has visualized itself as the future center of the steel industry. Although such enthusiasm is scarcely justified by the facts, nevertheless it is true that steel production at Detroit is due for further expansion in the next few years. Great Lakes Steel Corp. shortly will begin construction of a four-high continuous hot strip and cold reduction mill which will greatly enlarge its sheet making capacity. It is believed that the necessities of competition, especially if any changes are made in the present steel rate structure, will force mills far distant from the southern Michigan market to erect steel plants in or near Detroit if they wish to continue to sell or to expand tonnage to the automobile industry.



William Shutt, 78 years old, representative of a group of Chevrolet employees whose average age is 71 years and who report regularly for work. Mr. Shutt has been regularly employed by Chevrolet since March, 1922. With 24 other veterans he will visit the new Chevrolet plant at Camp Holabird, Md., and then visit points of historical interest in and about Washington and Baltimore.

Detroit Basing Would Up Prices in Nearby Cities

WASHINGTON.—If the NRA plan to establish group-mill bases in the steel industry were adopted, Detroit would become a basing point for sheets, hot rolled strip, merchant steel bars, cold rolled strip, blooms, billets and slabs and pipe. The Detroit 50-mile area would include the producing points of Ecorse, Monroe and Dearborn, Mich.

The effect that would come from making Detroit a base is, of course, dependent upon prices that would be established on the Detroit base. That would be the point on which automotive consumers would center their interest.

Detroit buyers now pay, for example, \$205 for 100 lb. for hot rolled strip steel, quoted on a Pittsburgh base, while buyers at Toledo, Ohio, which is not and would not be made a base pay \$2.08½. If Detroit is made a base for this product, as long as the Detroit base is 17½ cents over the Pittsburgh price, the same relationship between prices at Detroit and prices at Toledo will obtain. If, however, as the NRA report points out, the Detroit base is lowered to 10 cents over the Pittsburgh

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Important States Back Aggressive Factory Relations Program for NADA

PHILADELPHIA, March 20.—Backed by a number of important state dealer organizations, an aggressive program of action on factory-dealer relations issues will be presented at the meeting of the executive committee of the National Automobile Dealers Association to be held in St. Louis tomorrow.

If the present system of distribution is to be preserved the program asserts, it is immediately essential that steps be taken to protect the dealer's normal gross profit on clean-up operations, and that changes in the basic relationship between factory and dealer be effected by conferences between authorized representatives of the dealers and the factories. To this end, the program says that the president of the NADA should immediately appoint a committee of five dealers and request formally that the manufacturers appoint a similar committee to confer with the dealer group forthwith.

The primary requisite toward a better understanding on all sides is facts, the program declares. Consequently the program urges that definite steps be taken immediately to accumulate facts to be used in negotiations and that these facts be made the basis of a brief to be presented to the manufacturers by the dealer committee. Continuing, the program says that the brief should be submitted with the idea of obtaining a definite answer from the factories in time to be effective in the present selling season and that dealers submitting it be free from reprisals for their participation.

It is understood that if the NADA executive committee does not adopt this program, or some suitable substitute, that the states backing it plan to carry it out independently.

Chrysler Adds Traveler Sedan to Airstream Line

A new 133-in. wheelbase Traveler sedan with built-in trunk and priced at \$1225 has been added to the Chrysler Airstream eight line. Among the features of the new model are unusually wide doors, the bottom width of the front door being 42 in. and of the rear door 25½ in. The floor of the rear compartment measures 47½ in. from the front of the back seat to the rear of the front seat when in the middle position. Thus with the foot rest in normal position, there is considerable space for additional luggage.

Waukesha to Boost Pay

Waukesha Motor Co., Waukesha, Wis., manufacturers of truck, tractor, bus and industrial engines, has announced that on April 1 it will make effective a 5 per cent increase in the wages of its entire working force. The raise will be the third since wages struck a low level.

Opinion Inclines Toward Makers' N. Y. Show in Nov.

Opinion in the industry is leaning toward a manufacturers' show in New York the first week of November. This time would coincide with the industry's plans this year for introducing new models in the fall. The show question is expected to be discussed and probably decided at the next meeting of directors of the AMA to be held in a few days.

NRA to Study Motor Codes Overlapping

Research Group Will View Facts With Consolidation Idea as Principal Goal

WASHINGTON—Study is being made by an NRA research committee of three members with a view to eliminating overlapping of and conflicts in automotive codes. It is expected the study will be completed in about six weeks or two months. The committee was appointed at the request of the National Industrial Recovery board by D. M. Nelson, director of code administration, the personnel includes Lieut. Kilbourne M. Johnson, son of Gen. Hugh S. Johnson, chairman; Divisional Administrator Burton W. Mur-

ray and Deputy Administrator Karl J. Ammerman, in charge of finance codes. Divisional Administrator Murray was elected as a member of the committee because his division, No. 2, has charge of most of the automotive codes. Deputy Administrator Ammerman was chosen because he formerly had charge of automotive codes. Lieutenant Johnson is the representative of Mr. Nelson.

The committee is not an administrative board but is to report to the NIRA. The study embraces efforts to do away with overlapping and conflicts in automotive codes and the possible consolidation of a number of the lesser codes into a master code. The more important codes, such as the one covering automobile manufacturing, will be continued as separate codes. The plan for consolidation of some of the codes is in line with suggestions made last week before the Senate Finance Committee by Donald R. Richberg, director, National Emergency Committee, when he suggested a general merging of so-called small industries codes into as small a number as is practicable.

The codes will be analyzed by the committee and after the study is made it will be submitted to deputies in charge of all automotive codes and possibly to the affected industries, and the study laid before the NIRB. It is doubted that any action will be taken until after Congress passes legislation regarding extension of the Recovery Act.

W-R Promotes Daisley

R. H. Daisley, for 12 years in charge of sales and sales engineering at the Saginaw plant of the Wilcox-Rich Corp., has been appointed executive supervisor of the plant in charge of all activities, a recent company announcement states.



Courtesy of Detroit News

Engineers of the "Big Three" judge entries in the Detroit Society of Model Engineers' competition. From left to right, in the foreground, they are G. P. Hallett of GM; Carl Breer, Chrysler, executive engineer, and L. S. Sheldrick, Ford chief engineer. At extreme right is William E. Scripps, president of the Detroit News

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

There was no pronounced change in business activity last week, but there appeared to be several signs of stability. The operating schedules of the heavy industries were generally maintained at the levels in the preceding week. There was an upturn in retail trade, with a noticeable growing demand for spring merchandise as Easter approaches.

More Car Loadings

Railway freight loadings during the week ended March 9 amounted to 587,270 cars, which marks a decrease of 17,372 cars below those in the preceding week, a decrease of 26,850 cars below those in the corresponding period last year, but an increase of 145,909 cars above those two years ago.

Dept. Store Sales Strong

Department store sales during February showed an increase, whereas they usually change very little during that month. The Federal Reserve Board's adjusted index for that month stood at 75, based on the 1923-25 average as 100, as against 72 in January and 77 in December. The value of February sales was 5 per cent above that in the corresponding period last year.

Current Consumption Gains

Production of electricity by the electric light and power industry in the United States during the week ended March 9 was 4.7 per cent above that in the corresponding period last year.

Lumber Business Active

Production of lumber during the week

ended March 9 was only slightly above that in the corresponding period last year, while new business was 4 per cent above that a year ago and 21 per cent above production. There was a reduction from the preceding week in the level of shipments, but it was still 11 per cent above that a year ago.

Crude Output Exceeds Limit

Average daily crude oil production in the United States for the week ended March 9 amounted to 2,526,400 barrels, which was slightly above the Federal allowable figure, as against 2,473,850 barrels for the preceding week and 2,313,900 barrels for a year ago.

Federal Reserve Statement

For the third successive week, the consolidated statement of the Federal Reserve banks showed no changes in holdings of discounted bills, bills bought in the open market, and government securities.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended March 16 stood at 81.7, as against 81.8 the week before and 82.0 two weeks before.

—Oakland, San Francisco, Brooklyn, Seattle, Chicago; and April 20 to 30—Atlantic City.

April 27 to May 4—Memphis, Nashville, New Orleans, New Haven, Baltimore, Omaha, Pittsburgh, Richmond, Rochester, San Antonio, St. Louis, Wichita, Kan., Wilkes-Barre, Albany, Charlotte, N. C., Cincinnati, Cleveland, Dallas, Davenport, Iowa, Dayton, Des Moines, Grand Rapids, Indianapolis, Jacksonville, Kansas City, Los Angeles, Portland, Ore., Spokane, Houston, Tex.

May 4 to 11—Minneapolis, St. Paul.

P-A Creditors Get Stock In Reorganization Plan

The principal provisions for the reorganization of the Pierce-Arrow Motor Car Co. call for transfer to the new corporation of all property and other assets including cash necessary for reorganization. Real estate on which mortgages are outstanding are not to be transferred, according to announcements from Buffalo.

The new concern will have an authorized

capital of 50,000 shares of seven per cent cumulative preferred stock of \$5 par and 200,000 shares of \$5 par common, of which only 120,000 shares of the latter will be issued on formation of the new company. Old stockholders are to receive no cash but will get a prior right to subscribe to the new preferred issue at par. Each creditor with a claim in excess of \$20 will receive in full settlement one share of the new common for each \$20 of debt. Ten per cent will be paid to unsecured creditors of the Pierce-Arrow Sales Corp.

NICB to Study Machine's Place in U. S. Industry

A comprehensive survey of the extent of mechanization in industry, machine production, machine displacement of labor and technological unemployment will be made by the National Industrial Conference Board, Inc., with a view to collecting statistics and establishing facts concerning the place of the machine in the American industrial and sociological scheme of things. The study will be sponsored by the National Machine Tool Builders' Association.

Subjects which have been selected for study include: "Population and Gainful Employment," "Ratio of Wages to Value Added by Manufacturers," "Growth of Machine Producing Industries," "Declining and Expanding Industries," "Employment in the Production of Machines," "Wage Rates and Hours of Work," "Wage Rates in Mechanized and Non-Mechanized Industries," and other related matters.

Budd Co. Employing 1500 Men on Ford, Packard Jobs

All Ford closed cabs for commercial cars and bodies for Ford pickup and panel-delivery trucks, together with some miscellaneous steel parts for assembly at Ford branch plants, are being manufactured by the Edward G. Budd Manufacturing Co. The work is giving employment to 1,500 men in its Philadelphia and Detroit plants.

The Budd Co. also announced that it is manufacturing doors for the new Packard cars.

End of Code Contribution Exemption Order Asked

The Code Authority for the automotive chemical specialties manufacturing industry has petitioned NRA for termination of the exemption under which members of an industry were relieved from contributing to the support of a code other than the one which covered their major line of business. Suggestions or objections concerning the application may be submitted to Deputy Administrator Earle W. Dahlberg before Saturday, April 6.

New P-A Distributorship in Buffalo Headed by Winslow

A new organization with headquarters in Buffalo has been formed to handle western New York distribution of Pierce-Arrow

Cars, Trucks, Appliances GM Spring Show Features

Beginning April 6 and continuing until May 11 General Motors will hold its annual spring showings of automotive and household products in 51 principal cities throughout the country, Alfred P. Sloan, Jr., president, has announced. Each showing will be for one week.

Latest GM developments, not only in cars but also in corporation activities and the household appliance field will be embodied in each exhibit. At many of the shows Chevrolet and GMC trucks will be included in the display.

Exhibiting cities and their show dates this year are:

April 6 to 12—Louisville; and April 6 to 13—Milwaukee, Philadelphia, Providence, Toledo, Tulsa, Washington, D. C.; Atlanta, Birmingham, Buffalo, Detroit, Newark, N. J., Boston.

April 20 to 25—New York; April 20 to 27

cars and White and Indiana trucks and buses, according to Thomas J. O'Rourke, Pierce-Arrow general sales manager. Dallas E. Winslow, former Michigan automobile distributor, heads the new organization. With Mr. Winslow are several former Pierce-Arrow sales and service executives.

Other officials of the new company are Harry M. Williams, vice president and general manager. Formerly Mr. Williams was associated with the Pierce-Arrow sales organization. William G. Shortall, who has been associated with P-A for 25 years, is in charge of sales, and Fred J. Wells, formerly national service manager for P-A at the factory is general service manager.

Duncan Rejoins Rose as Sales Manager

D. D. Duncan replaces Floyd T. Reuter as sales manager of the Frank Rose Manufacturing Co., according to an announcement from officials of the company. Mr. Duncan began work with the Rose organization more than 20 years ago and has been with the company continuously with the exception of about 18 months. For 15 years he was sales manager and it is to this position he has returned.

Herndon Named Valspar Secretary-Treasurer

E. T. Herndon has been elected secretary and treasurer of the Valspar Corp. Formerly Mr. Herndon was associated with the J. Henry Schroeder Banking Corp.

30-Hr. Bill Favorably Reported to Senate

The Senate Judiciary Committee favorably reported the Black 30-Hour Bill and the measure reached the floor of the Senate this week.



C. G. Krieger; named vice-president of the new SAE Tractor and Industrial Power Activity, and John A. C. Warner, the society's general manager.

SAE Adds 10th Professional Activity in Tractor and Industrial Power Group

Foreshadowing a greatly increased interest in tractor and industrial power problems, a tenth professional activity of the Society of Automotive Engineers has been authorized, to be known as the "Tractor and Industrial Power Activity" of the society.

The creation of this activity was decided upon at a meeting of the SAE Council, held in Detroit last week to consider a petition for its creation submitted by the Tractor and Industrial Power Committee of the society. The petition was prepared by a sub-committee of the Tractor and Industrial Power Committee, of which A. W. Lavers, of the Minneapolis Moline Power Implement Co., was chairman; the other members were Elmer McCormick, of the John Deere Tractor Co., Waterloo, Ia., C. E. Frudden, of the Allis Chalmers Mfg. Co., Milwaukee, and C. K. Krieger, agricultural engineer with the Ethyl Gasoline Corp., Detroit.

In presenting its petition, the sub-committee nominated C. G. Krieger for vice-president of the proposed activity, which was confirmed by the council. Mr. Krieger is to serve until the end of the 1935 term.

The movement for the creation of this activity has been under way for some time. In September, 1933, at the International Automotive Engineers Congress, sponsored by the SAE in Chicago, 98 visitors at the meeting requested that a tractor committee be established by the SAE. This committee was authorized and organized the Tractor and Industrial Power Committee with C. G. Krieger as chairman. This committee sponsored the following national meetings of the SAE on tractor subjects: Milwaukee, April 18 and 19, 1934, attendance of 240; Chicago, December 5 and 6, 1934, attendance

400. At the Chicago meeting, as a result of the increase in interest, it was voted unanimously to request the SAE council to authorize the creation of a professional activity status for the tractor and industrial power group.

In past years tractor engineering has had a large part in the meetings of the SAE. In 1916, the Society of Tractor Engineers became affiliated with the SAE and a vice-president of the society represented this group until 1929, when the present organization of professional activities was inaugurated. The first vocational division meetings of the society ever held was sponsored by the tractor engineering group in 1917.

In presenting its petition for the establishment of the new activity, the tractor and industrial power group presented strong evidence to show that the new activity would have the support of the industrial organizations' representatives.

Chrysler Corp. to Redeem \$30,150,500 Dodge Bonds

The Chrysler Corp. has called for redemption on May 1 the remaining \$30,150,500 of Dodge Bros. Corp. six per cent debentures. Liquidation of this indebtedness will be by means of a \$25,000,000 loan arranged with the Chrysler's Corp.'s regular depositary banks equally divided in five yearly maturities. The balance of \$5,150,500 plus a premium of \$1,507,525 will be provided from the corporation's own funds.

Explaining the action of the directors in calling the bonds, Walter P. Chrysler, chairman, said that redemption means a yearly saving of approximately \$1,200,000 after the first year and provides an orderly liquidation of the debt which otherwise would have had to be met in full in 1940. Mr. Chrysler also explained that the maturity of the notes by which the liquidation is effected amounts to substantially less than half the corporation's annual amortization and depreciation charges in recent years; preserves the corporation's strong financial position and consequently does not constitute any material drain on present cash resources. It is reported that the rates on the credits compare favorably with similar loans made by other companies in recent months.

On November 1 of last year the Chrysler Corp. called \$10,000,000 of the Dodge bonds for redemption.

Reo Increases Outlets

Reo Motor Car Co. added eight new distributors and 33 new dealers to its domestic sales organization during the first 12 days in March, compared with the previous six weeks' record of six new distributors and 58 new dealers, according to C. A. Triphagen, general sales manager of the company.

Hill Joins Lukens

Erle G. Hill, formerly with the Mellon Institute of Industrial Research, has joined Lukens Steel Company, Coatesville, Pa., as Director of Research.

Ford Installing New Plate Glass-Making Equipment

To Resume Manufacture at Rouge Plant in Winter-Project Costs \$3,000,000

The Ford Motor Co. is making preparations to install new glass manufacturing equipment in the glass factory at the Rouge Plant and is expected to resume glass manufacture next winter. The cost of the project will approximate \$3,000,000, increasing to some \$23,000,000 the cost of the present expansion program at the Rouge Plant, which will raise its capacity to 5,000 cars per 16-hr. day.

Ford has not engaged in glass manufacture at the Rouge Plant for three years. The original equipment installed for the "continuous" process, is now moved out of the glass plant to make way for the new machinery.

When the installation is complete and glass manufacture is resumed, the glass plant will employ an additional 1,000 workers. The glass plant is now engaged in the production of laminated "safety" glass, utilizing glass supplied by outside manufacturers, 1,400 men being employed in these operations. The new installation will provide only sufficient capacity to supply a part of the company's glass requirements.

The new "big unit" will comprise twin 600-foot lines including two 75-ton melting furnaces, annealing furnaces, grinding and polishing machines capable of producing 90-inch wide ribbons of one-eighth inch plate glass at the rate of 150,000 square feet every 24 hours. Each line will have 60 grinders and 100 polishers.

One of the new melting furnaces and its companion annealing furnace, or "lehr" as it is known in the glass industry, have already been installed. Preparations are under way for the installation of the second melting furnace and the other equipment.

Green Asks Employers Individually for Hearing

(Continued from Page 401)

cials, a "reflex of what corporations are doing along similar lines."

The work will include cooperation with the emergency education program of the Federal Government in offering classes to organized labor groups in such subjects as collective bargaining, public speaking, parliamentary practice and labor problems.

A semi-monthly forum has been inaugurated in connection with the Detroit Trade and Labor Council, and a semi-monthly educational program for officials in connection with the Detroit Automobile Workers' Council meeting. It is planned to hold special conferences for officials of labor organizations and to give particular attention in training courses on labor organization history, principles and practice for recently organized unions. A workers' library is being developed and a research and information bureau will be conducted to assist organization officers and members in meeting their problems.

Recent nominating elections of the Auto-

mobile Labor Board have shown further slight gains in the affiliation with the A. F. of L. whose percentage of the total vote has crept up to 7 per cent. The federation made its best showing in the International Harvester Truck plant at Fort Wayne where, as the result of campaigning, it obtained 728 of the 2,169 votes cast, or 33.6 per cent. Circulation of hand bills at the Harvester plant was a new departure for the union which at all other elections has held aloof, advising its members not to vote. The unions showing at the Chrysler plant at Newcastle, Ind., also was considerably better than its average, 699 out of 2,350 votes or approximately 30 per cent being cast for the A. F. of L.

Matthew Smith, general secretary of the Mechanics Educational Society of America, became a participant Tuesday in the ALB program, being the first national officer of a trade union to do so. Mr. Smith accepted the nomination to a place on the official employees' bargaining agency to be set up for the Chevrolet Motor Co. Foundry at Saginaw where in district 20 he received 100 votes against 13 for the next highest candidate. The MESA officers have heretofore declined to participate in the Board's program and has not a single member in the plant that nominated Mr. Smith.

Dodge to Spend \$250,000 On Addition to Truck Plant

Realization that the Dodge truck plant on Lynch Road, Detroit, now building 300 commercial cars and trucks a day, is rapidly reaching capacity, has caused the management to decide to erect an addition to the present factory. Contracts have been let and work will begin in a few days, according to Wm. J. O'Neil, general manager of Dodge. The addition to cost \$250,000, will be a one-story structure 576 feet in length by 96 feet wide, giving 55,296 additional sq. ft. of floor space.

The immediate purpose is simultaneous expansion of practically all departments, with the greatest benefit accruing to the truck chassis and final assembly line which, by having its length increased through the removal of the machine and small parts paint shops to space afforded by the addition, will be enabled to step up its operations.

The change will also facilitate finishing operations on heavy truck and platform assemblies and give greater speed to domestic and export shipping.

Warner at Capacity On Improved Brake

Capacity operation is reported by the Warner Electric Brake Co., Beloit, Wis. The plant has been working at top speed since late in 1934 and, in recent weeks, orders have increased to the point that 24-hr. operation is demanded.

Following the company's reorganization, R. E. Freeman, president of the Freeman Shoe Corp. of Beloit, was elected president. Elbert Neese, president of the Beloit Iron Works, is now on the board of directors and is interesting himself actively in the



Harry Fleming

management of the company. Harry Fleming heads the sales division.

H. W. Tinker, for 19 years chief engineer of the Federal Pressed Steel Co. of Milwaukee, was appointed works manager shortly after the reorganization, and on his recommendation large investments have been made in new plant equipment. In addition, refinements have been made in the brake itself, a major one being a new brush-type controller with carbon resistances and 30 stages of gradation.

New Dual Purpose Sedan by Plymouth \$635 List

Plymouth is now offering a "dual purpose commercial sedan" priced at \$635. The new job has been added in response to a demand for a car that could be used for both business and pleasure. Outwardly, except for a large door, 42½ in. high and 34¼ in. wide, in the sloping rear panel, the car has the appearance of a two-door sedan. The rear seats are removable and when replaced by a floor, afford 2700 sq. in. of loading space in the rear compartment. Panels can be snapped into place quickly inside the rear windows to protect the glass and to provide a place for commercial signs.

U.S. Acts Against Pick Co. Charging 7a Violation

WASHINGTON.—Criminal suit was filed this week in the Milwaukee District Court by Assistant United States Attorney L. Hugo Keller against the Carl Pick Mfg. Co., manufacturer of automobile parts, charging violation of Section 7a of the Recovery Act. It is alleged the company discriminated against 11 union employees whom the National Labor Relations Board had ordered reinstated. The company, it is said, had refused to reemploy the workers and the Board asked the Department of Justice to file suit. Previously the Blue Eagle was removed from the company by the NRA.

First 1935 Million Off the Lines

(Continued from Page 401)

As generally happens in an active new car market, used car stocks begin to climb. They have not yet reached the point where they are causing concern, but unless more pressure is exerted by dealers to move used cars it will not be long before national stocks reach an uncomfortable level.

February new passenger car registrations from 24 states show a total of 67,671, as compared with 34,444 during February, 1934, an increase of approximately 96 per cent. In these states, Ford is in the lead with 25,287, as against 10,558 a year ago. Chevrolet is second with 11,567, as compared with 8,071 and Plymouth is third with 10,947, as against 6,196 for the like period of 1934. Ford is showing an increase of 140 per cent over February, 1934; Chevrolet, 43 per cent, and Plymouth, 77 per cent. Registrations of "big three" cars represent 71 per cent of total sales for those 24 states during February, as compared with 72 per cent in the same month a year ago.

With 4,522 retail sales in the first 10 days of March Oldsmobile set another new high mark which exceeded the previous record for that period in 1929 by 72 per cent. It exceeded the same period of 1934 by 320 per cent and was 12 per cent ahead of the final 10 days of February.

Deliveries of 7,973 Plymouth cars during the week ended March 16 showed a gain of 5.3 per cent over the preceding week and 13 per cent over the corresponding week of last year. For the first 11 weeks of this year Plymouth deliveries totaled 69,272, against 41,872 for the same period last year.

Dodge dealers delivered 7,746 cars and trucks, including Plymouths, during week of March 16, against 6,960 units in the preceding week, an increase of 11.3 per cent. The cumulative figure for the first 11 weeks of 1935 is 60,495 units, against 35,024 for the similar 1934 period.

Retail deliveries of Chrysler dealers in week ended March 16 established a new high for the last 35 weeks, with 3,071 Plymouths and 923 Chryslers delivered, an increase of 4.3 per cent for Plymouth and 2.8 per cent for Chrysler over the preceding week. The combined total of 3,994 units is 32.2 per cent higher than a year ago. Deliveries of Chrysler cars alone in the first 11 weeks of this year totaled 6,407, against 1,064 for the same period of 1934.

With production of its new "120" increasing daily Packard finds a marked increase in sales of its higher priced cars, which company officials interpret as indicating that the fine car buyers are coming back into the market. Registrations for the three months ending with February show that Packard's higher priced car business exceeded that of the corresponding months a year ago by 43.5 per cent. Sales of super-eights and twelves during this period represented 34 per cent of the total, against 31 per cent a year ago. The company expects that peak production capacity of its 120 plant, laid out for 5,000 cars a month, will be reached shortly.

Shipments of Nash and LaFayette motor cars during January and February of this year showed an increase of 152.5 per cent over the same period in 1934.

Export shipments of Auburn cars for the months of January and February of this

year were the greatest in any similar period in the history of the company and surpassed the entire export shipments for the year 1933, R. S. Wiley, export manager announces.

February, 1935 export orders for White and Indiana trucks were 232 per cent of orders received in February, 1934, and 40 per cent greater than for the entire fourth quarter of 1934.

Car Makers Refute Richberg-Barkley Allegations

(Continued from Page 402)

mobile freight cars which has effected substantial savings in the decking of cars. By and large, shipments by truck are now confined principally to a radius of 250 miles. Beyond that distance, railroads are on a favorable competitive basis with trucking companies. Even on the shorter haul shipments are not made by truck "at infinitely lower cost" as the senator from Kentucky stated. The differential ranges roughly between 10 and 25 per cent in favor of trucking.

In an effort to obtain greater share of the automobile shipments to Chicago, railroads are reducing their rates between Detroit and Chicago to 50 cents per hundred pounds from 62 cents, effective April 15.

While long distance drive-aways are much less common than a few years ago, caravans still are made up for the Pacific Coast, but cars brought over-land by that method are so labeled by authorized dealers and sold at a discount.

The policy of the larger manufacturers of charging freight from Detroit or Flint on cars turned out by their assembly plants in various sections of the country has no parallel in the steel industry's basing point system of establishing prices for its products. In the first place, the motor companies have no agreement nor is the policy covered by the manufacturers' code. Companies operating assembly branches obviously have an advantage over competitors

in being able to save the freight differential by shipping finished cars from the nearest assembly branch but not all the differential is savings since most of the parts must come from the home plants. Because of the keen competition that exists the saving is promptly translated into a lower f. o. b. price. In fact the volume producers are said to be working on so small a margin that the freight differential constitutes an important proportion of the profit. If it were eliminated, it undoubtedly would result in a higher list price.

Only three companies in the motor industry operate domestic assembly branches. Sixteen out of the 34 Ford branches are assembly points. Chevrolet has 10 and Chrysler one. The competition between these producers is so strong that obviously no one can retain any savings gained by shipping advantages. In fact the life-long record of the industry, showing annual improvement of its product with its price trend generally downward is ample evidence that no artificial price structure exists to the detriment of the car buyer.

APEM Code Hearing On Definitions Postponed

The National Industrial Recovery Board has announced that the hearing on the definition in the APEM code, which was held on Feb. 27 and recessed until March 20, was again recessed until April 22 by Division Administrator Barton W. Murray.

It is expected the code authority for the automotive parts and equipment industry at its earliest convenience will submit to the NRA a list of products, for the manufacture and sale of which the proponents of the automotive parts and equipment code claim that they are truly representative under Section 3 (a) of the Recovery Act. When this list is submitted, it will be published and the public hearing will be reconvened to determine the question of representation in the case of each of the listed products. All interested persons will then have an opportunity to be heard.

CALENDAR OF COMING EVENTS

SHOWS

Machine Tool Exposition—Cleveland
Sept. 10-21

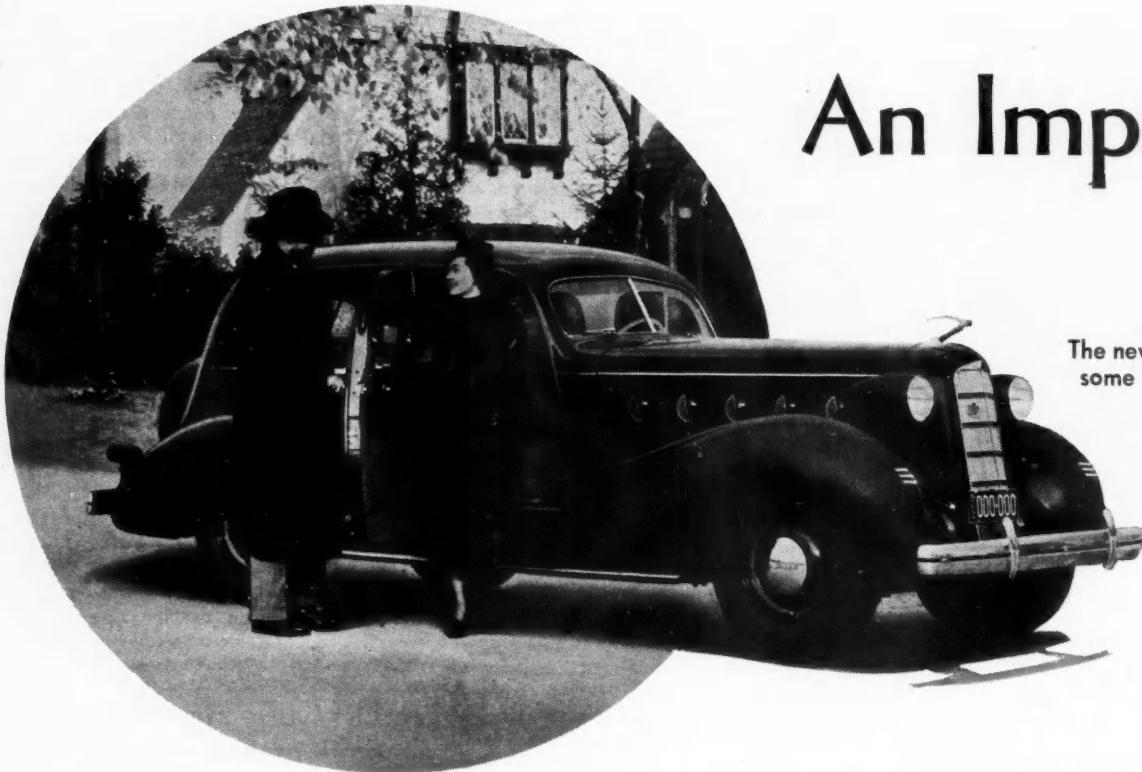
CONVENTIONS AND MEETINGS

American Gas Association, New York, April 13-14
American Chemical Society, New York, April 22-26
American Welding Society, Annual Meeting—New York City.....April 25
U. S. Chamber of Commerce Annual Meeting, Washington, D. C. Apr. 29-May 2
American Society of Mechanical Engineers (National Oil and Gas Power Meeting), Tulsa, Okla. May 8-11
National Battery Manufacturers Assoc. Spring Convention, Cleveland, May 22-23

Automotive Engine Rebuilders Assoc.
—Indianapolis May 27-30
S.A.E. Summer Meeting—White Sulphur Springs, Va. June 16-20
American Society for Testing Metals, Detroit June 24-28
American Society for Metals, Annual Meeting—Chicago Sept. 30-Oct. 4
National Safety Council, Louisville, Ky. October 14-18
American Gas Association—Atlantic City Oct. 14-18
American Petroleum Institute—Los Angeles Nov. 11-14
National Industrial Traffic League—Chicago Nov. 20-21

RACES

Race—Indianapolis Race, Indianapolis, May 30



An Improved

The new sedan presents some attractive lines

A CONSIDERABLE increase in the power-to-weight ratio, adoption of turret tops, improvements in the choking system and the charging control, still more advanced styling, and a sharp drop in price are the principal points in the announcement of the new LaSalle by the Cadillac Motor Car Co. this week. List prices range from \$1,225 to \$1,325.

Four body styles are offered, including a two-door, five-passenger

touring sedan, a two-passenger coupe, a four-door touring sedan, and a convertible coupe. Sedans have integral trunks, while the convertible coupe has a rumble seat, which latter may be had also on the two passenger coupe at extra cost. All closed bodies have the steel turret top.

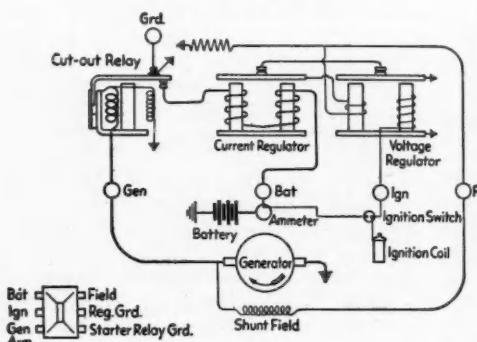
Cylinder dimensions of the eight-cylinder in-line engine have been increased from 3 by 4 1/4 to 3 by 4 3/8 in., thereby increasing the displacement from 240 to 248 cu. in. The standard compression ratio is now 6.25, while an optional compression ratio of 5.75 is being offered. While this

represents a slight reduction in the compression ratio as compared with last year's engine, it is claimed that an increase in output has been achieved by the adoption of an improved type of cylinder head and various developments in carburetion, valve design and manifolding. The new engine, it is stated, does not require premium gasoline. Its rating is 105 hp. at 3600 r.p.m.

Oil is now distributed to the main and camshaft bearings through leads drilled in the block, instead of through copper tubes. The water-jacket opening and cover found on the 1934 engine have been discontinued.

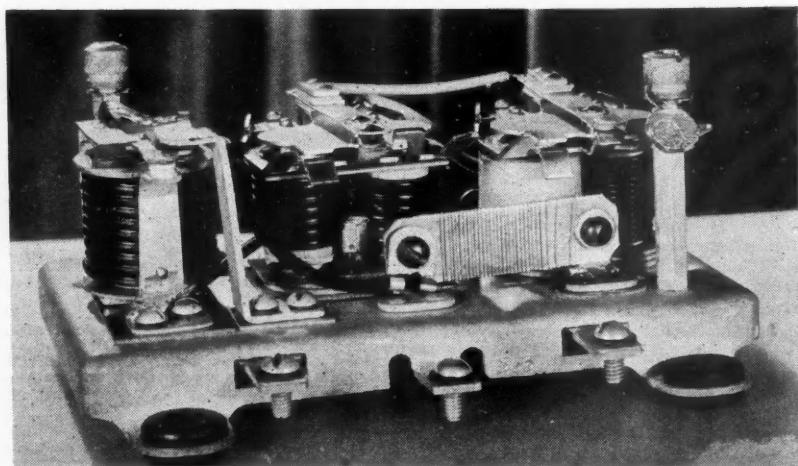
The aluminum pistons of this year's model are of a new design. Instead of a T slot, they have merely

Diagram of charging circuit



Charging control unit

(Battery cut-out on left, current control switch in center and voltage control unit on right, with field resistance unit in foreground.)



LaSalle Listing at \$1225 to \$1325

a circumferential slot immediately below the ring belt on each of the two bearing sides, ending in large drill holes. The weight of the piston has been reduced. Valve-spring dampers have been eliminated, and instead the three coils at the upper end are now spaced closely. Valve springs are stiffer, to prevent tappets leaving the cam at high speeds. Connecting rods have been strengthened

switch is closed, a small current passes through the heating coil and heats it up at the proper rate suitably to reduce the choking during the warming-up period of the engine. The thermostatic coil is connected directly to the end of the choke-valve shaft, thereby eliminating a linkage and the accompanying friction, which has a tendency to interfere with the proper functioning of

Features

Closed bodies have turret tops. Stroke increased $\frac{1}{4}$ in. to $4\frac{3}{8}$, making piston displacement 248 cu. in. This increase with new cylinder head and other refinements have raised maximum power from 95 at 3,700 to 105 at 3,600.

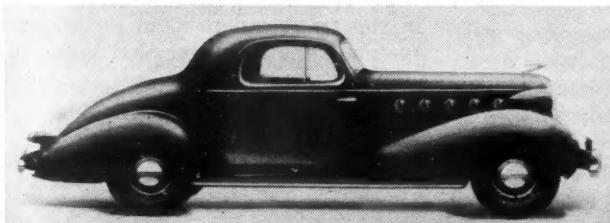
Manual and automatic operation of the choke.

New rear axle, clutch and transmission.

Voltage control of generator added.

Wheelbase increased from 119 to 120 in.

Weight reduced about 400 lbs., which, with increase in engine output, gives weight per hp. of 34.5 lbs. against 43 lbs. last year.



The coupe of the new LaSalle line for 1935

at the junction of the shank with the upper boss. The oil pump is of larger size than last year and a change has been made in the pitch of its gears, whereby its capacity has been increased about 50 per cent.

A change has been made in the method of engine mounting. At the front end the engine is now supported by a rectangular rubber block at the middle of the front cross member, while at the rear there are two rubber mountings, located somewhat farther forward than last year. This shifting of the rear points of support is said to smooth the engine at high speeds and to prevent side shake made evident by movement of the shift lever.

In connection with the fuel system, the chief improvement is in the choke, a new type known as the "triple-range" being used. Choking is partly automatic and partly manual. The choke thermostat is built into the carburetor, and instead of being actuated by the heat of the exhaust, it is actuated by an electric heating coil. When the ignition

the automatic mechanism. The vacuum piston used to open the choke valve when the engine starts running is also built into the carburetor.

In addition to the automatic control, hand control is provided for the choke, in the form of a button on the instrument panel. This button is normally in its middle position, in which case the choke valve is under the sole control of the thermostat. If the button is pulled out,

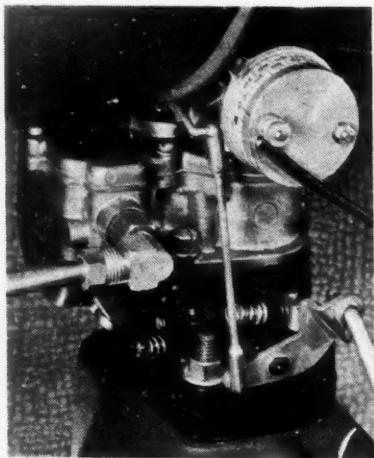
the engine is choked manually independent of the thermostat, and if it is pushed in beyond its normal position it prevents closing of the choke valve by the thermostat.

The water pump, which is built in a unit with the fan, now has Durex bushings, which are sufficiently porous to permit the oil to seep through to the shaft, and they therefore have no drilled oil holes. The spring-loaded by-pass valve in the cooling system has been discontinued, the water now being bypassed through a small pipe connecting the pump chamber with the water jacket.

Load control of generator output, whereby the amount of current generated is automatically increased whenever the lights, the radio, or any other consuming device is turned on, is continued from last

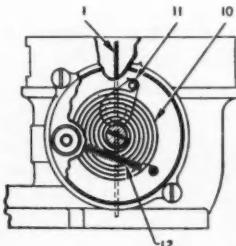
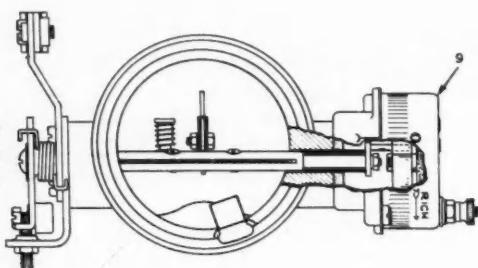
The new front of the 1935 LaSalle



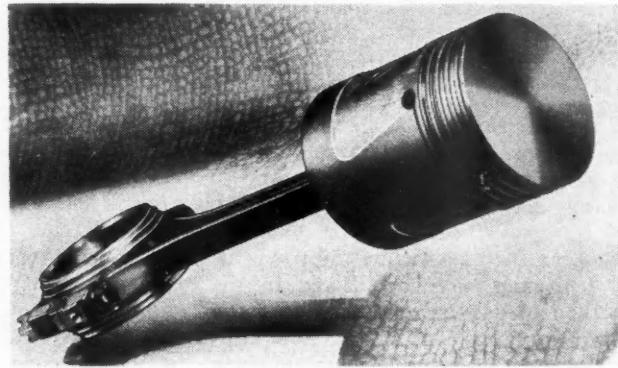


Stromberg downdraft carburetor with inbuilt choke control

Diagram showing arrangement of automatic and manual choke controls



Piston and connecting rod



year. In addition, voltage control of generator output is now used, instead of the third-brush system. A vibrator switch connected across the generator mains alternately cuts a resistance into and out of the field circuit, thereby tending to keep the voltage at the generator terminals constant. The result is that when the battery is in a low state of charge, there will be a larger difference between its voltage and that of the generator, and it will charge at a more rapid rate.

The field current is carried through both the voltage regulator and the current regulator contacts, and a single resistance is used for both, so that if either set of contacts is open the resistance is included in the field circuit. A voltage regulator tends to maintain the voltage at a higher level when hot than when cold, because of the greater resistance of its coil when hot, while the charging voltage required by the battery is greater when its cold. It is therefore necessary to doubly compensate for temperature, which is accomplished by means of a bimetallic hinge on the armature. A diagram of the charging circuit is shown herewith. The storage battery of the electrical system has 17 plates and a capacity of 110 amp-hrs.

The single-plate clutch has been

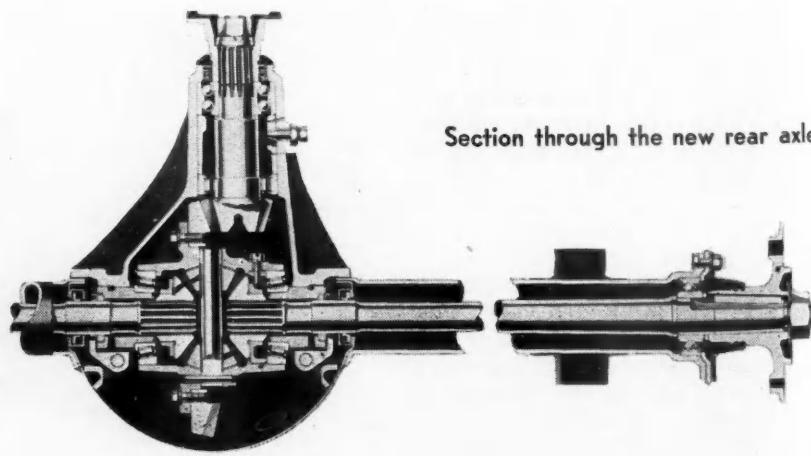
redesigned and is said to be smoother in operation and to have longer life. Clutch facings have an outside diameter of 10 in. and an inside diameter of 6 in. Nine pressure springs are used.

A number of improvements have been made in the transmission. Countershaft gears are more effectively lubricated by oil holes in the transmission housing and an oil scoop in the center of the countershaft gear cluster. Thrust washers on the countershaft and reverse idler now are stationary instead of floating. An oil reservoir has been added

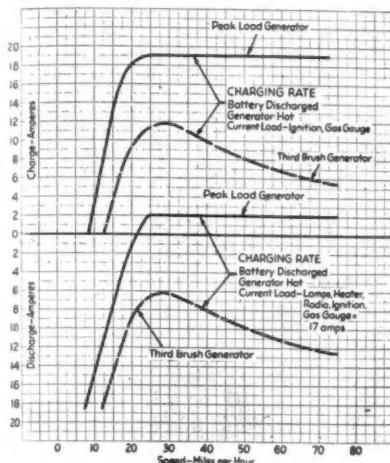
at the rear of the second-speed constant-mesh gear.

A rear axle weighing 140 lb. and of new design is used. As may be seen from the sectional drawing reproduced herewith, it is of the semi-floating type. A somewhat unusual feature is the mounting of the differential housing on two taper roller bearings whose outer races are lodged in bores of the differential housing while the inner races are mounted on sleeves screwed into the gear carrier. This arrangement is the reverse of that usually employed, in which the inner race of the bearing is mounted on a hub of the differential case. One end of the differential housing is bored out to a sufficiently large diameter so that the differential side gears can be inserted through it. After the gears are assembled the opening is closed by a threaded collar locked in position. The cover of the center housing is welded to the axle housing. The rear-axle ratio has been reduced from 4.78 to 4.55 and the engine now makes only 3245 revolutions per mile traveled.

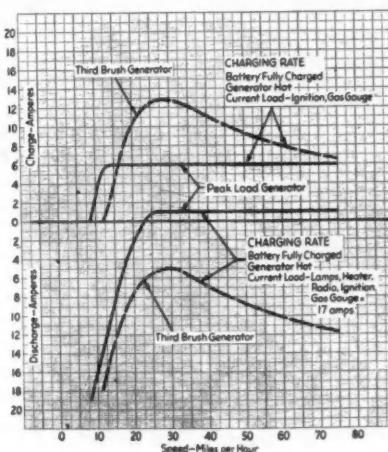
Several changes have been made in the front independent suspension system. The reinforcement plate for



Section through the new rear axle



Comparison of charging rates of Peak Load and third-brush generators under various Conditions of Operation



left-hand panel carries the instruments, while the right-hand panel forms a glove-compartment door into which a clock may be installed. Near the bottom of the instrument panel there are two rectangular headlight beam indicators.

The lighting switch is at the left side of the instrument panel, with the starter switch immediately below it. Centrally on the instrument panel are the ignition switch, map lamp, cigar lighter, throttle and manual choke button.

Hydraulic brakes are fitted as last year, but the wheel cylinders are now of the double-piston type and are mounted on the brake backing plate. There is also an additional retracting spring on the brake shoes. Front cylinders have a larger bore than the rear cylinders, and 55 per cent of the force of brake application is applied to the front brakes.

Springs have been made softer and the valving of the shock absorbers has been improved. Front ends of rear springs are mounted in rubber, while the shackles at the rear end have rubber bushings at the top. Graphite bronze inserts between the leaves of the rear springs have been discontinued, and springs are now packed in graphite grease.

The wheelbase has been increased from 119 to 120 in.

Evidently the car has been lightened considerably, for the new model is said to weigh only 34½ lb. per hp. which with a rating of 105 hp. gives a weight of 3622 lb., while the old model which had a rating of 95 hp. is said to have weighed 43 lb. per hp., so that its total weight must have been about 4085 lb.

the front cross member has been eliminated and the lower suspension arms are pivoted at their inner ends on a solid shaft secured to the under side of the frame front cross member. The intermediate steering arm is now mounted on the outside at the rear of the front cross member, instead of on the inside.

Bodies of the new series of cars are new, both in appearance and in structural details. Steel panels and posts are welded together. Windshield posts are of all-steel construction and the instrument panel is an integral part of the shroud assembly, these parts being held together by the truss structure which also serves as toeboard riser. This construction increases the rigidity of the body. The windshield is of the V type and the two windshield wipers supplied are placed below it.

New type door handles are used and there is safety glass in all windows.

The gasoline tank filler neck is located in the right rear fender, instead of the left one, because the former is less exposed to damage. In the sport coupe the spare tire is carried beneath the rear deck, except in fender-well jobs. In convertible coupes the spare tire is carried in a right fender well, which is standard on that model. Two panels are inset into the new instrument panel and edged by narrow chrome strips. The

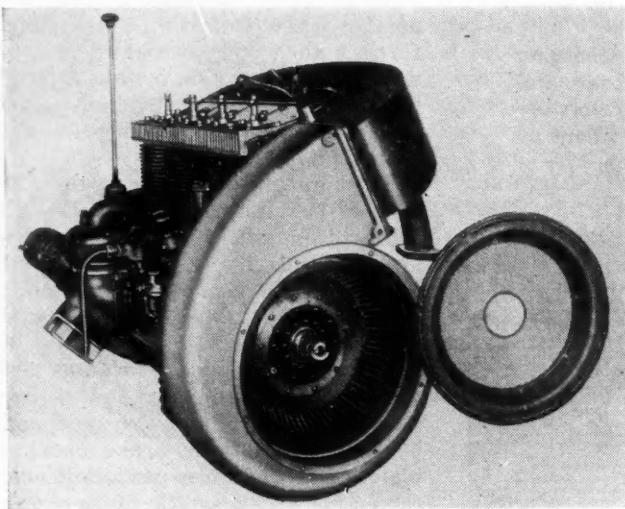
Steel Developed to Match Expansion of Aluminum

In his presidential address to the Sheffield Society of Engineers and Metallurgists, A. J. Grant mentioned some recent outstanding results of collaboration between engineers and metallurgists. An aircraft-engine designer wished to place, in juxtaposition in an engine, a steel and an aluminum alloy, but the dissimilarity between the coefficients of expansion which normally exists between the two materials was a source of difficulty. The cooperation of metallurgists was secured and, as a result of experiment, a nickel-chromium-manganese austenitic steel was produced, having not only the necessary

mechanical properties, but also a coefficient of expansion identical with that of the aluminum alloy. Hence, the engineer's problem was solved. The past achievements of metallurgists had undoubtedly been considerable, but the future possibilities, as further knowledge of the structure of matter became available, were almost as great. Only 18 months ago, it had been shown that if 30 per cent of nickel and 12 per cent of aluminum be added to steel, an alloy was obtained the magnetic properties of which greatly surpassed those of any material previously available. This was amazing

because it had never entered into the minds of anyone that a high proportion of nickel or high proportion of aluminum, or indeed both together, would have any such effect.

Automatic Radio Manufacturing Co., Inc., Boston, Mass., has made an announcement of its 1935 line of automobile radios, the leading model of which is the Automatic Jr. Twin-Six. This is a six-tube receiver with 6-in. dynamic speaker and an airplane dial for steering post or instrument-panel mounting. The line also includes a DeLuxe Model A-6.



Phaenomen four-cylinder blow-
er-cooled truck engine

LIKE the passenger-car industry, the German commercial-vehicle industry has confined itself mainly to the refinement of details. There was little new in the way of Diesel engines at the Berlin show. Existing designs were further improved and here and there a new model was brought out, on the same lines as previous products. Thus the Büssing-N. A. G. company added a five-cylinder model to its line of high-speed Diesel engines for trucks and buses, and the Vomag concern introduced a horizontal eight-cylinder railcar engine of 185 hp., under Oberhaensli license. The new Büssing-N. A. G. engine develops 78 hp. Henschel & Son also produced an eight-cylinder, 175-hp. engine on the Lanova system.

The Maybach Motor Company showed a new 12-cylinder direct-injection engine developed from its well-known 410-hp. engine but developing 600 hp. M. A. N. has followed suit with a 12-cylinder unit producing 420 hp. at 1400 r.p.m. and having the cylinders ar-

ranged in two banks of six, the same as the Maybach and the Daimler Benz. It was reported that an order for 39 of these engines had been placed by the German State Railways. The feature of the M. A. N. engine is that although the two banks of cylinders are arranged at an angle of 40 deg., it has two crankshafts which are geared to a central shaft driving the generator, which can be driven at 4/3 crankshaft speed. Some of the engines come through with mountings for superchargers. Injection is by M. A. N. pumps and nozzles.

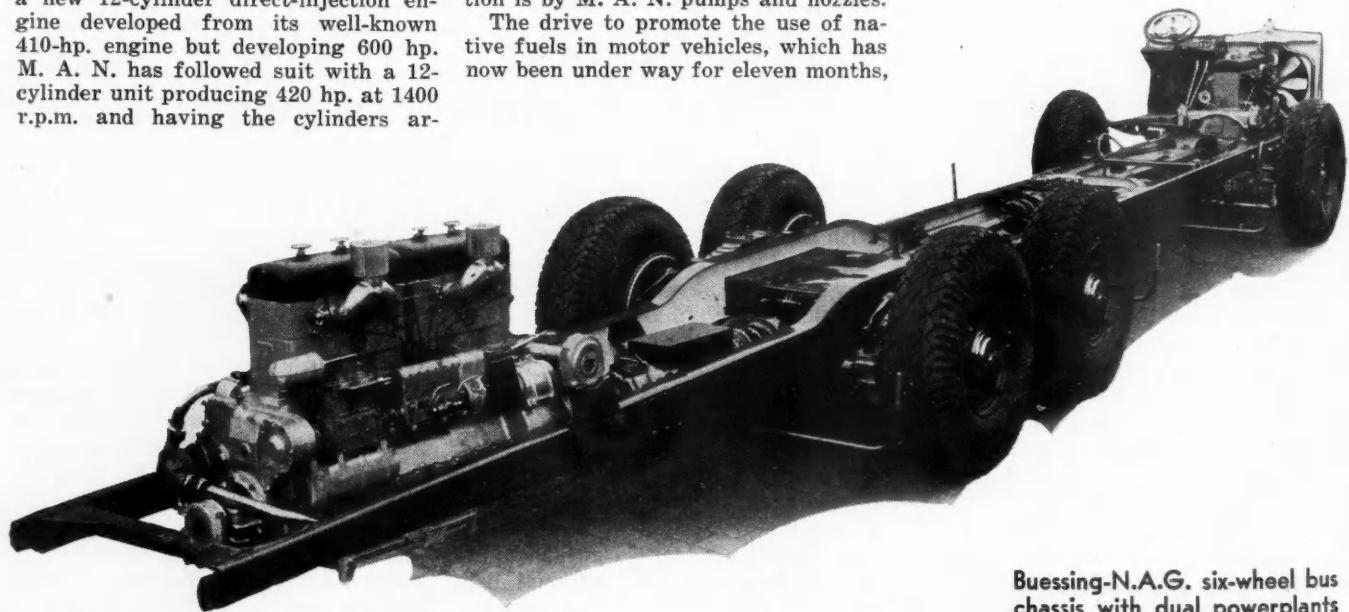
The drive to promote the use of native fuels in motor vehicles, which has now been under way for eleven months,

by Edwin P. A. Heinze

Berlin Correspondent
of Automotive Industries

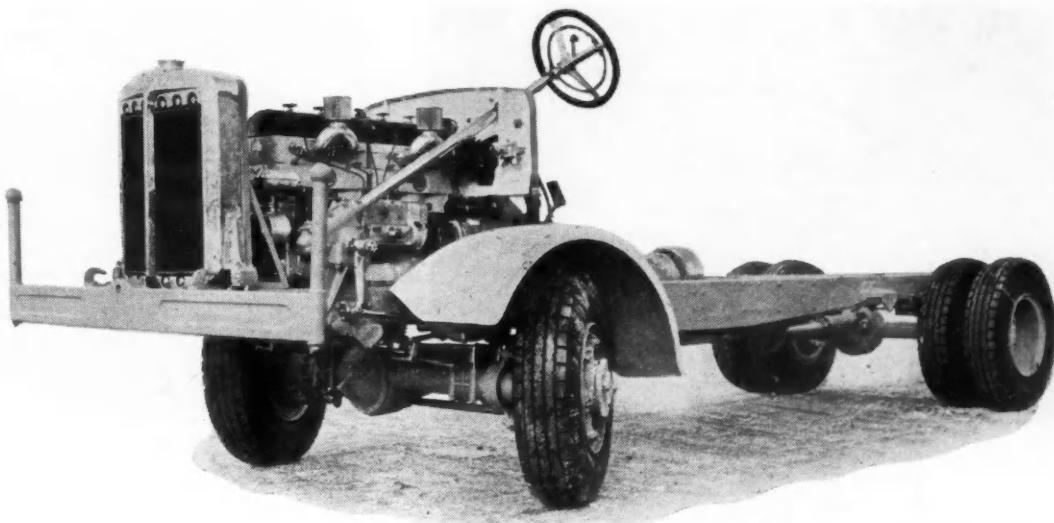
Detail Refinements and Bus Engineers,

was reflected at the show by an increased number of trucks, tractors and buses equipped with one or the other of the six or seven makes of gas generators on the German market. Even such important firms as the Humboldt-Deutz Motor Co. are engaged in the development of such systems. The Imbert, which has been under development for a good many years, is also found on several vehicles. A distinction must be made between generators



Büssing-N.A.G. six-wheel bus chassis with dual powerplants

Buessing - N.A.G.
four-wheel-drive
truck



Gasoline Occupies German Truck Berlin Show Reveals

Diesels dominate as government grants tax reduction on vehicles with gas generators; new high-speed highways fostering design of streamlined buses

designed to burn wood exclusively and those which operate on charcoal and various other fuels, including lignite.

One of the leading makers of commercial vehicles in Germany does not recommend vehicles with gas generators, however. The firm claims it has tested all of the various generating systems and is ready to supply trucks equipped with them on order, but believes the systems to be inferior to the regular gasoline or Diesel powerplants. The engines operated on generator gas are for the most part gasoline engines which have been modified so as to work with a compression ratio of 10 to 1. Thus the firm of Henschel & Son will equip its 250 hp. dual coach engine for generator-gas operation.

The German Government has just promulgated a law which grants a very considerable tax reduction on vehicles equipped with gas generators, but the law was not announced until the end

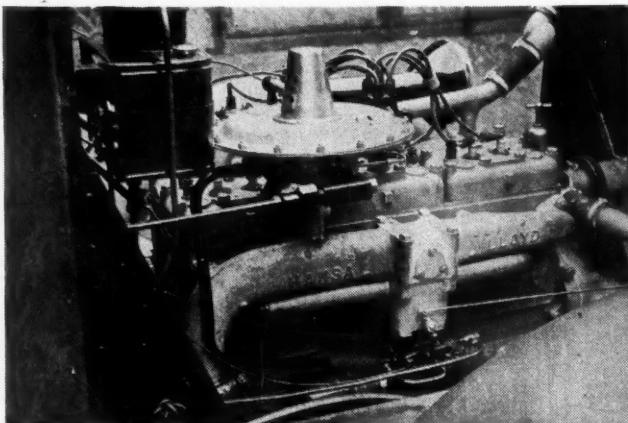
of the show, consequently did not affect the exhibits. It does not seem likely that even this concession will so develop the use of producer-gas vehicles as to endanger the further development of Diesel engines, which still absolutely dominate the field.

In line with the agitation for the use of native fuels is the production, by Henschel & Son, of steam trucks and buses under Doble license. Several steam vehicles of this type are now operating satisfactorily in Germany. At the show the firm exhibited a 120-hp. steam coach chassis which attracted much attention. It is a four wheeler, with the boiler at the extreme rear and the condensers on opposite sides of it. The engine is mounted directly on the rear axle in cantilever fashion, the moment of its weight balancing the driving torque. As the boiler is adapted to burn cheap native fuels, such as coal and lignite—powdered coal is being

considered—the development is being looked upon with favor by the Government, and it is also being supported by the State Railways.

Attempts are being made also to introduce coal gas as a fuel for motor vehicles, the gas being carried in steel bottles slung under or at the sides of the frame. Quite a number of trucks are operated in this manner in the industrial districts of the Rhine and the Ruhr, where gas is widely distributed. Trucks carrying supplies of methane and other gases under pressure have a rather small radius of action—usually about 60 miles. The German Benzol Association now has introduced a form of liquefied gas known as Ruhrgasol, which can be carried in steel bottles on the vehicle. It consists of a mixture of liquid propane and propylene with additions of butane and butylene in which ethane and ethylene are dissolved. Ruhrgasol liquefies at pressures of 170-215 lb. per sq. in. depending on the temperature, and it can therefore be carried in comparatively light bottles. Besides, the Ruhrgasol bottles contain a much greater heat value, volume for volume, so the radius of action of the vehicles is greatly increased. No reducing valve is required, and the fittings therefore are simpler than those needed with the compressed gas. Unfortunately, the transportation of Ruhrgasol is rather expensive, and unless plants for its production are erected all over the country, its use is likely to remain confined to the districts mentioned, where it sells at 30 per cent less than the normal liquid fuels for internal combustion engines, on a heat-value basis. No changes need to be made in conventional gasoline engines to adapt them to operation on Ruhrgasol.

Owing to the fact that rapid progress



Hansa Lloyd engine fitted with mixing valve for operation on Ruhrgasol

is being made in the construction of the new system of super highways and that some sections are scheduled to be opened to traffic this summer, the commercial vehicle industry has been occupied with the design of high-speed coaches for use thereon. While the roads are being built to permit of speeds of well over 100 m.p.h., the industry at present is designing for maximum speeds of 75 m.p.h., and to make these speeds possible with relatively low engine powers, the coaches are radically streamlined. The outstanding chassis at the show was one by the Büssing-N. A. G. company, which was 45 ft. long. It was a six-wheeler and had power applied to the four rear wheels. The distance between the front and the forward driving axles is 16 ft. and the wheelbase of the driving unit, 5 ft. The turning radius is 41 ft. The chassis is equipped with a six-cylinder 140-hp. Diesel engine at each end. Each engine has an independent transmission system comprising a five-speed gearbox. The drive from the rear-mounted engine is to the forward driving axle and vice versa, this arrangement being used because otherwise the propeller shaft for the rear engine would be too short. Each drive incorporates a free-wheeling unit, so that either engine can be allowed to idle or can be shut down. Both gearboxes are operated synchronously by

means of compressed air, which is also used to apply brakes to all six wheels, while engine control is effected hydraulically. Only a single radiator is employed, of the sectional type, and is mounted at the front of the coach. This makes the radiator connections from the rear engine quite long, but the long pipes are used to heat the interior of the coach in winter time. Special super-balloon tires are fitted, of 13.5/20 in. size. The chassis weighs 7.2 tons and has a carrying capacity of 7.8 tons.

Daimler-Benz showed a streamlined coach equipped with a 95-hp. Diesel engine and with very luxurious appointments. The driver's seat is beside the engine on the left, and on the opposite side there is a seat for a conductor or attendant. The driver's compartment is partitioned off from the passenger compartment by glass. There are seats for 22 passengers and luggage can be stowed away in the sloping boot and under the seats. The front of the coach and the windshield are rounded, and its speed is given as 70 m.p.h.

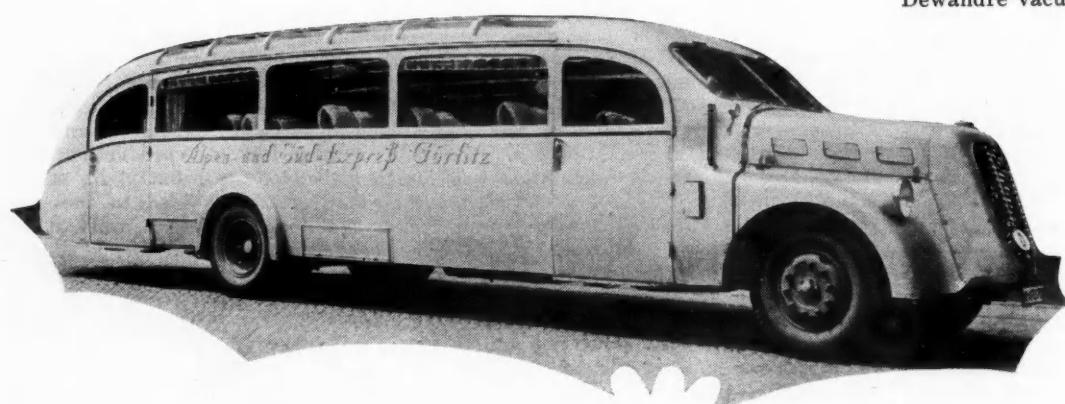
Several coach builders exhibited coaches built on the semi-trailer principle.

Nothing really new in the transmission line was shown and the fluid torque converter shown last year on the Henschel stand has not made any headway. This may be due to the fact

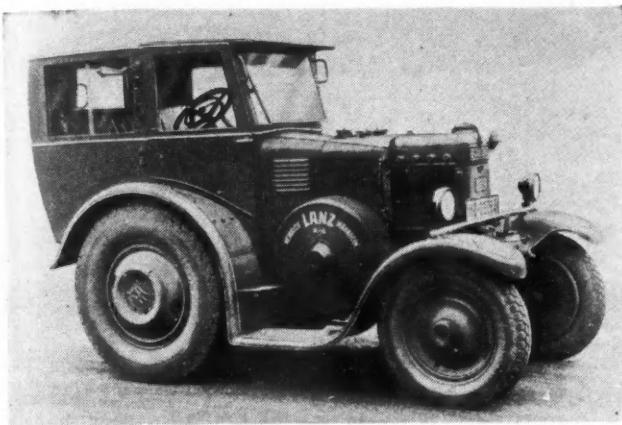
that mechanical transmissions have been developed to a high state of perfection. A new type of gearbox was exhibited by the Ardelt Company of Eberswalde, however. It comprises constant-mesh gears which are engaged successively by means of metallic multiple-disk friction clutches. A cam system permits of engaging the gears successively by means of a single operating lever.

Several "all-wheel-drive" trucks were exhibited again this year, including a four-wheeler by Büssing-N. A. G. and a six-wheeler by Mercedes-Benz. The Büssing is equipped with a six-cylinder Diesel engine of 135-145 hp. rating. The engine is mounted in the usual position over the front axle and power is transmitted from it through a two-plate clutch and flexible-disk universal joints to a separate four-speed gearbox combined with an overdrive which steps the speed up in the ratio of 1:1.48. From the gearbox the power is transmitted to a distributing gear in which there is a differential. Thence the power is transmitted to the two axles through propeller shafts enclosed in torque tubes with ball-ended supports. The universal joints in the propeller shafts are of the flexible-disk type, however, which seems to be gaining in favor again. Final drives to the axles are by double-reduction gears. There are twin universal joints at each of the steering heads.

The Daimler-Benz six-wheeler has independent suspension, but the drive is otherwise similar. Front wheels are supported from the frame by two links, one above the other, and suspension is on an exposed coil spring. Wheels are driven through universal-jointed drive shafts extending from the differential gear mounted on the frame, and there is a final reduction by gear and pinion in the wheel hubs. The engine is located in the usual position and the drive is through a five-speed gear box to the distribution gear which also contains a differential gear. A propeller shaft takes the drive to the worm driving gear of the forward rear axle, from where connection is made through another short shaft to the worm-gear drive of the rearmost axle. In this case also the final drive is through gears at the hubs. Whereas the Büssing-N. A. G. has air brakes, the Mercedes-Benz is equipped with the Bosch-Dewandre vacuum brake.



High-speed interurban bus equipped with eight-cylinder gasoline engine



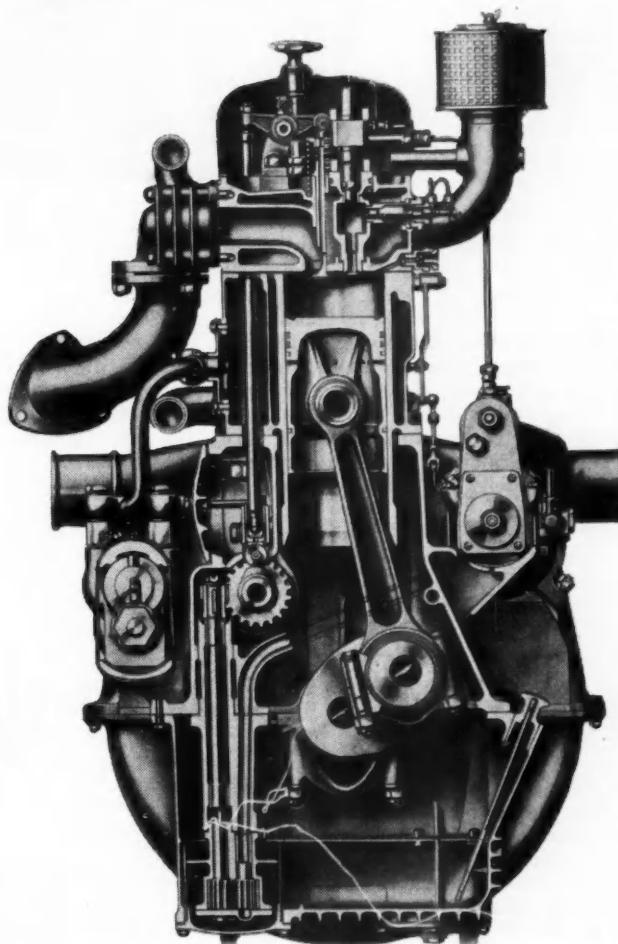
Lanz tractor for road and field service

Air brakes are in greater favor in Germany than ever before. The Bosch company has entered this field by the introduction of a new type of air compressor with rotating piston. The compressor has its own lubrication system and the compressed air is passed through an oil-extractor before entering the receiver. As soon as the receiver pressure reaches 71 lb. per sq. in., air delivery is automatically stopped and the compressor idles, but as soon as the pressure drops to 64 lb. per sq. in. it is cut in again.

The Bosch company also has developed a starting device for Diesel engines. It consists of a chamber connected to the inlet manifold, the chamber being fitted with a float and containing gas oil. Above this chamber there is a valve and above the latter an electric heating coil. When starting, the inlet manifold is closed by means of a throttle valve and the current is switched on so the coil becomes heated. If the engine is now being cranked, the suction lifts the valve in the float chamber and air enters through it. The air carries along some of the fuel, and upon passing through the heated coil of wire, this fuel is vaporized, hence the cylinders receive some warm fuel vapor, which facilitates starting. As soon as the engine fires, the throttle is opened, and the current is automatically switched off at the same time.

Numerously represented again this year were the small motor carriers with either air- or water-cooled engines, mostly of the two-stroke type. These are offered in considerable variety, with three or four wheels, front or rear drive, independent or conventional suspensions, in capacities up to 1 ton. Rather distinct from this class are the air-cooled trucks of the Phaenomen Company of Zittau. This company for many years has specialized in the manufacture of light trucks with four-cylinder air-cooled engines, of which the German Post Office alone has many hundreds in service, particularly in country districts. A new model has been added recently with a four-cylinder engine of 183 cu. in. displacement

Cross - section of Buessing - N.A.G. Diesel engine



and developing 55 hp. at 2800 r.p.m. The four deeply finned cylinders are arranged in line and are partly enclosed by a cowling through which air from a centrifugal blower on the forward end of the crankshaft is forced. The air supply is controlled thermostatically. Cylinders are iron castings but the cylinder heads are cast of light alloy. Cylinders are of the L-head type and the crankshaft is supported on ball and roller bearings in a barrel-type crankcase. Nelson-Bohnalite pistons are employed. Cylinder dimensions are 3.54 by 4.72 in., and the compression ratio is 5.6.

Mention should be made also of the numerous Diesel-engined tractors which are now being offered in Germany. Several firms now turn out tractors which are completely enclosed and not unlike sedans in appearance. The Lanz Company of Mannheim has brought out a new model of its Bulldog tractor with horizontal single-cylinder hot-bulb engine which, being fitted with pneumatic tires all around, can be used equally well for road and field work, and requires no driving lugs for field operations.

In conclusion, reference may be made to Diesel engine exhibits once more. An interesting innovation in this field is a new Daimler-Benz engine equipped with a new type of suction-controlled governor developed by Bosch. The governor comprises a cylinder open to the air pipe of the engine and containing a piston which is connected to the fuel-control rod of the injection pump. As the engine speeds up, the vacuum in the inlet pipe rises, the piston is drawn into the cylinder, and the fuel supply to the engine is cut down.

This engine is provided with a throttle valve in the inlet manifold similar to that used on gasoline engines, and speed control is largely effected by means of this valve, which is controlled by pedal. This system is applicable to the Daimler-Benz engine because the latter is of the precombustion-chamber type, fuel being injected into a precombustion chamber in which ignition is effected by means of a so-called burner which is not effectively cooled and therefore remains at a high temperature between successive cycles, so that the reduction in the compression pressure and temperature due to

Henschel Diesel-engined tractor with semi-trailer and two trailers in the service of a trucking concern



throttling of the air charge does not interfere with ignition. Ignition is said to be positive even if only half the normal charge of air is taken in.

This same type of governor is used also on other engines, including the Magirus, which is also of the precombustion-chamber type. This make of engine has forged rapidly to the fore in Germany and is now being offered in three models, one a four-cylinder of

45 hp., the other two six-cylinder designs, of 65 and 110 hp. respectively, and both operating at normal speeds of 2000 r.p.m.

A newcomer in the automotive Diesel field is the Kaelble. This is not an entirely new engine, however, for it has been manufactured for industrial uses for many years. A line of four and six-cylinder automotive engines ranging in output from 55 to 135 hp. is now

being offered. The feature of this engine is a substantially pear-shaped precombustion chamber in the center of the cylinder head. The lower portion of the chamber projects down into the main combustion chamber and is provided with radial spray orifices. The general arrangement is somewhat reminiscent of the Koerting, from which it differs, however, in that the spray orifices are radial.

The Parsons Fuel Injection Pump

THE accompanying drawing shows the Parsons fuel injection pump invented by Frederick L. Parsons, who is connected with the United States Diesel Corporation, 1105 Commonwealth Avenue, Boston. A sample pump was exhibited at the S.A.E. meeting at Saranac Lake last summer. This pump is of the type in which injection is effected by means of a powerful coiled spring, with the result that the pressure of injection is independent of the speed of the engine.

Referring to the drawing, the eccentric in the lower part of the casing is shown in its lowest position, and the space in sleeve 2 below plunger 1 contains a charge of fuel. As the eccentric continues to rotate, sleeve 2 moves upward and fuel is returned through the inlet port until the inlet duct passes out of registry with the inlet port in the sleeve.

As the fuel is now confined in the sleeve, any further motion of the eccentric and sleeve raises plunger 1 and compresses the heavy injection spring. As soon as the discharge port in the sleeve (on the left) begins to register with the discharge passage, the fuel is ejected from the sleeve by pressure of the injection spring on the plunger.

It will be seen that the plunger is drilled axially from the lower end, the drill hole communicating with a slot in the surface of the plunger. At the same time that the discharge port comes into registry with the discharge passage, the by-pass slot in the plunger comes into registry with the by-pass port in the

sleeve. This is said to assure a rapid cut-off at the end of injection.

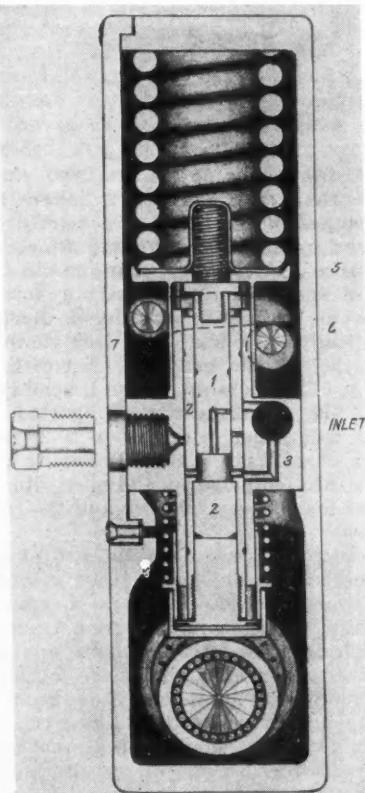
Continuing its motion, the eccentric

returns to its lowest position. Sleeve 2 is held in contact with the eccentric by the return spring, which surrounds the lower part of the sleeve. Plunger 1 is held against a film of oil at the bottom of the sleeve by the injection spring. Before the eccentric reaches its lowest position, guide 5 of the injection spring comes in contact with barrel 3 and the spring seats. The small spring on top of the plunger now forces the latter down until it comes up against the variable stop 6. The position of this stop controls the amount of fuel injected per cycle.

The main casing of the pump is so designed that it can be machined in one straight-line milling operation, the ends being closed by cover plates, one of which supports the bearing and filter. A large number of casings can be machined in one set-up on the milling machine.

Each unit is assembled separately and then introduced into the case from the side. Thin gaskets are placed between units, and the cover plates are then put on, squeezing the gaskets, which forms the inlet seal. When the cover plate is replaced the units are permanently anchored.

Owing to the great length of the high-pressure seal, a superlative degree of final hand lapping of the parts is not required, it is claimed. For the final stage of lapping it is possible to run the high-pressure parts together, which is said to reduce the cost of what is ordinarily the most expensive operation in building an injection pump.



Section through Parsons injection pump

JUST AMONG OURSELVES

AFL Claims Discredited by Final ALB Balloting

If the attitude of workers in the automobile plants toward the ALB elections is as the A. F. of L. paints it, it is rather difficult to explain why, almost without exception, more votes have been cast in the final elections than in the primaries. Moreover, in the finals scarcely any blank ballots have been cast, whereas in the primaries they amounted to over 2 per cent of the total. Certainly it would seem that if the workers were as lacking in confidence in the whole procedure as the A. F. of L. maintains, they would have registered their feelings by casting blank ballots in the finals.

* * *

Dealers Press for Contract Revisions

EVIDENCES multiply that dealers are looking increasingly to changes in their contractual relationships with the factories, rather than to their code, for an improvement in their profit opportunity. In fact, considerable pressure is developing for early aggressive action on the program presented by NADA President Vesper at the annual meeting in Detroit last January. With new models due in the fall this year, there is a growing feeling that unless steps are taken at once to secure the desired changes, another year will go by without any progress. Presumably, how the dealers propose to go about achieving their ends will be re-

vealed following the meeting of the NADA executive committee scheduled for Thursday of this week.

* * *

"Bug-Free" New Models for 1936

PERHAPS it's a little early for speculation on the characteristics of 1936 models, but there are some indications now that radical changes on most lines are unlikely. With the new model season set forward to the late summer and early fall, the time for development work is scant and hence some engineers at least believe that the best thing to do under the circumstances is to concentrate on the elimination of "bugs" in this year's models. If this policy is followed widely, next year's cars should come as close to being "bug free" as anything the industry has produced in a long time.

* * *

Funded Debt Nears Vanishing Point

COMING on top of the Studebaker refinancing, the announcement that Chrysler was calling all of the outstanding Dodge debentures focuses attention again on the industry's almost unique position in the matter of funded debt.

At the end of 1933, the book value of the motor vehicle manufacturing companies amounted to approximately \$1,775,000,000, against which the funded debt amounted to about \$57,000,000, or a little more than 3

per cent. Now, the funded debt amounts only to about \$9,000,000 as a result of a reduction of over \$8,000,000 in Studebaker obligations and the calling of \$30,000,000 in Dodge debentures in addition to the \$10,000,000 that were retired last year.

In the case of Chrysler, of course, only \$5,000,000 of debentures are being paid off, the balance being replaced by bank loans at lower interest. But this conversion in times like this is a tribute in itself. Moreover, after the first year, Walter P. Chrysler says \$1,200,000 will be saved annually in interest, or 28 cents a share on the common, which should be cheering news to Chrysler stockholders.

* * *

Third in Radio Advertising

THE automotive industry ranked third last year in dollars spent for radio advertising. Drugs and toilet goods were first; foods and beverages were second.

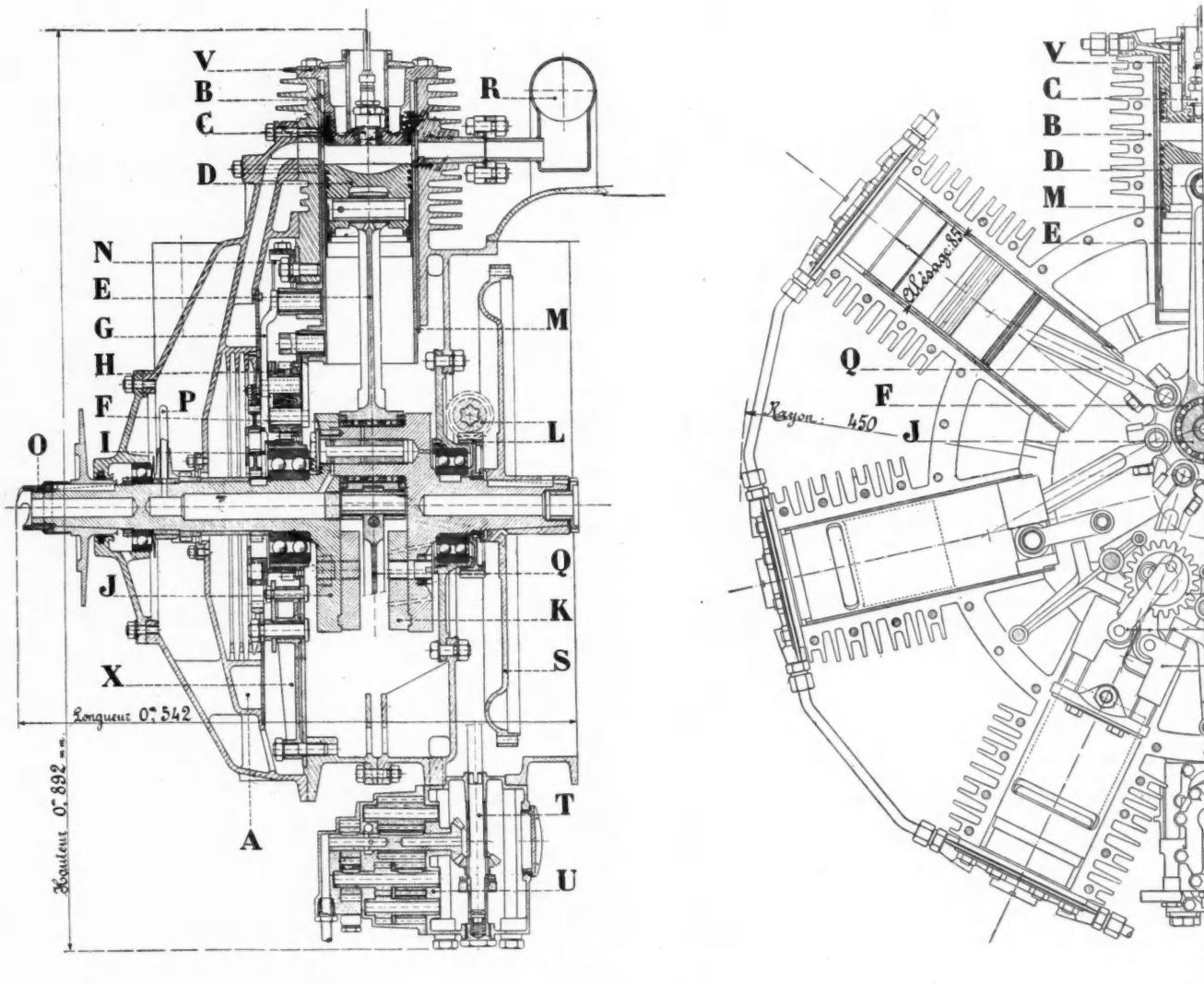
Ford topped the automotive radio expenditure list with \$1,191,577. General Motors, with Chevrolet, Buick, Cadillac, Oldsmobile, Pontiac and AC Spark Plug all on the air in addition to a corporation institutional program, totaled \$1,054,184 for these automotive units. Chevrolet was the biggest of the General Motors spenders with \$342,028 and Pontiac was second with \$235,244.

After Ford and General Motors ranks Studebaker with \$284,818, Hudson with \$268,452 and Packard with \$94,556.

The automobile companies which increased their radio effort in 1934 as compared with 1933 include Cadillac, Chevrolet, Pontiac, General Motors institutional, Ford, Packard and Studebaker.

The Editors

Voisin Describes New Engine with "Wearless"



A, inlet piping cast integral with the front cover; B, cylinders in two parts assembled by means of bolts; C, spark plug and mounting for same; D, magnesium piston with three compression rings and one oil-control ring; E, master rod with roller bearing, pressure-lubricated; F, roller bearing of master rod; G, short connecting rods for the valve sleeves; H, eccentrics operating the short connecting rods of the sleeves; I, planetary pinions operating the connecting rods of the valve gear; J, two-piece crankshaft; K, counterweight on crank arms; L, pinion and gear of pump drive; M, cast iron

valve sleeves; N, guides for valve sleeves which obviate the risk of breaking of the sleeves; O, starting crank coupling; P, point of entry of oil under pressure into the crankshaft; Q, link rods; R, exhaust; S, flywheel enclosing the clutch comprising a torus dragged along by oil and held in the end position by an electro-magnetic plate; T, oil-pump driving shaft; U, oil pump; V, aluminum cylinder head in which are chill-cast two steel parts, for supporting the spark plug and the junk ring respectively; X, cross bar of valve gear assuring the proper spacing of the planetaries operating the eccentrics.

Radial Knight Valve Gear

M. GABRIEL VOISIN, the French automobile manufacturer who created quite a stir at the Paris automobile show last fall by the announcement of his lozenge-shaped "automobile of the future," now passes along the information that he has completed the design of the engine. Mr. Voisin explains:

"We naturally picked the Knight sleeve-valve engine with two sleeves, because of all known engine types it is the one from which the highest thermal efficiency may be expected. Recent improvements have given it a degree of reliability which was hardly attainable some years ago. This marvelous engine possesses a wearless valve gear with scientifically fixed timing. Moreover, the presence of the mov-

ing sleeves prevents all wear on cylinder walls, which permits of furnishing customers with engines which fifteen years after delivery will still give the same output as when first leaving the works.

"But what technical difficulties have to be overcome in the development of a Knight valve gear for a radial engine!

"I grew pale over my drawing board for 17 days and I slept among planetaries, gear carriers and epicycloidals for a whole month. Success, however, finally smiled on us. I succeeded in developing a valve gear in the form of a separate cylinder which measures 1 3/4 in. in thickness. This valve gear is provided with safety guides, thanks to which an accident to a sleeve is reduced to an incident that need

cause little worry. Finally, the engine in its assembled form is accessible, simple and light.

"We are in hopes of making a dynamometer test of the engine on Feb. 3, 1935. If God is with us we will have some pleasant emotions on that day. If the devil should get a hand in it, we will conduct the work of eliminating the bugs the way it should be done, and we shall succeed, because we know what we are after and I also know that I have the assistance of men of merit, trustworthy and great workers, on whom I can depend."

Well, M. Voisin no doubt has made his bench test by this time, and here is hoping that the devil was not overactive on the fateful day and did not throw any monkey wrenches into the valve gear.

Sectional drawings of the Voisin radial air-cooled sleeve-valve engine (3.34 by 4.13 in.) are reproduced herewith. The engine has an overall diameter of 35 3/8 in., is designed to develop 120 hp. at 3000 r.p.m. and weighs 460 lb. with carburetor, ignition equipment and exhaust collector.

U.S. Production and Deliveries of Aircraft by Types, 1934*

	Production			SALES		
	Number	Per Cent of Total	Net Sales Value	Per Cent of Total	Number	Per Cent of Total
Open Cockpit Biplanes						
1 place	103	13.34	\$441,858	4.43	106	13.68
2 places	26	3.37	97,145	.98	24	3.10
3 places	27	3.50	126,405	1.27	33	4.25
Over 3 places						
Total	156	20.21	\$665,408	6.68	163	21.03
Cabin—Single-Engined Biplane	112	14.51	480,950	4.83	105	13.56
Cabin—Multi-Engined Biplane	16	2.07	885,000	8.89	16	2.06
Total Biplanes	284	36.79	\$2,031,358	20.40	284	36.65
Open Cockpit Monoplanes						
1 place	1	.13	825	.01	2	.26
2 places	62	8.03	162,015	1.63	67	8.64
3 places	..	..	..	..	..	..
Over 3 places	..	..	..	..	..	..
Total	63	8.16	\$162,840	1.64	69	8.90
Cabin—Single-Engined Monoplane						
1 place	1	.13	17,000	.17	1	.13
2 places	134	17.37	389,455	3.91	135	17.43
3 places	60	7.72	180,028	1.81	57	7.35
4 places	93	12.06	246,218	2.47	95	12.25
5 places	3	.39	48,700	.49	2	.26
6 places	12	1.56	192,652	1.93	16	2.06
7 places	2	.26	62,532	.63	3	.39
8 places and up	28	3.64	1,211,208	12.16	28	3.61
Total	333	43.13	\$2,347,795	23.57	337	43.48
Cabin—Multi-Engined Monoplanes	77	9.98	4,827,874	48.48	66	8.52
Total Monoplanes	473	61.27	\$7,338,509	73.69	472	60.90
Seaplanes	6	.78	408,978	4.11	7	.90
Amphibians	8	1.03	167,007	1.68	9	1.16
Autogiros	1	.13	11,750	.12	3	.39
Total	15	1.94	\$587,735	5.91	19	2.45
Total—Commercial	772	100.00	\$9,957,602	100.00	775	100.00
Total—Military	437	..	8,836,509	..	434	..
Grand Total	1,209	..	\$18,794,111	..	1,209	..

* Aeronautical Chamber of Commerce of America, Inc., The Aircraft Year Book for 1935.

New Methods and Materials New Opportunities and New

CONSISTENTLY improved performance and better quality—at consistently lower cost are the almost antagonistic objectives that dominate the engineering and manufacturing philosophy of all progressive elements of the automotive industry.

With increasing pressure due to competitive conditions as well as the constant drive for lower costs in every direction, the engineer is placed squarely in the limelight. Today the engineer has a signal opportunity to dominate the entire picture, the extent of this influence depending upon his grasp of the dynamic and fast changing developments in the field of materials, production processes, and new production equipment.

If the engineer will work more closely with machine tool designers; if his new designs are based upon the utilization of new equipment and new processes, we will enter a truly revolutionary phase of automotive history.

Let us consider a few of the technical problems confronting the engineer and the manufacturing organization:

1. Better engine performance—higher speed, greater output, better economy.

2. Chassis units, such as transmissions, axles, clutches, smaller in size but capable of greater specific load capacity.

3. Demand for quiet transmission gears at low cost.

4. Better cylinder finish.

5. Better and more durable body and sheet metal finish.

6. Decrease in the weight of all components without affecting life and serviceability.

7. Constant decrease in production cost.

8. Ability to meet competition on the basis of product design and low cost.

It is quite obvious that the forward march of the industry as a whole and the welfare of individuals in it rests with the most skillful utilization of men, materials, and methods, not forgetting equipment.

Materials

1. Availability of a great variety of alloy steels for every purpose.

* Abstract of paper read before joint meeting of Cleveland Chapter, A.S.M. and Cleveland Section, S.A.E., March 11, 1935.

2. Recent development of new engine bearing materials—high lead content copper alloys, cadmium silver, satco lead, etc. These bearings permit greater loads, higher speeds, softer journals, and thus are responsible for much of the current advance in engine performance.

3. Use of light alloys of aluminum and magnesium to reduce the weight of engines and chassis parts.

4. Various other non-ferrous alloys including zinc alloy die castings and high strength brass castings.

5. Machinable grades of stainless steel.

Another application of surface broaching that is having wide acceptance is the cutting of bearing locks in the cylinder block, formerly a milling machine operation. This was first done by Plymouth in the fall of 1932 on a hydraulic machine built by Cincinnati Milling Machine Co., and has been producing blocks at the rate of 110 per hour. This method is now being used by Pontiac and Packard. More recently Nash installed a new Cincinnati broach which turns out blocks at the rate of 60 per hour.

Improvement in metal cutting has been brought about by the wider use of Stellite and the cemented carbide tool materials which permit higher speeds and feeds, better surface finish; also the finishing of materials which are most difficult if not impossible to cut with any other type of tool.

Closely allied with this development are the various ingenious machines for lapping gears after heat treating or shaving gears before heat treating in an effort to produce quiet transmission gearing without great expense for finishing.

Through the activity of various independent bodies, as well as commercial organizations, we have entered an important phase of improvement in plating finishes either for decorative purposes, as with chromium plating, or as protective finishes, in the case of Udy-lite, Cadalite, Bonderizing, Parkerizing, and the electro-tinning and alumilizing of pistons.

Simplification Through New Materials and Processes

One of the brightest pages in current production is the simplification of procedure and cost-reduction through the proper coordination of materials, processes and new equipment. Here are just a few prominent examples:

1. Introduction of the alloy iron camshaft and crankshaft had an immediate effect on cost-reduction. It eliminated carburizing as well as the plating operations incidental to the production of camshafts; it eliminated straightening and reduced the number of metal-cutting operations usually required.

2. Replaceable cylinder liners and long-wearing valve seat inserts have made possible a wider use of aluminum and magnesium castings for cylinder

by Joseph Geschelin*

Engineering Editor,
Automotive Industries

Processes

The past few years have seen a great wave of technical change in production processes and manufacturing equipment. Perhaps the most revolutionary change was the introduction of surface broaching as a primary mass production process which displaced, almost over night, many well-intrenched milling machine operations.

Surface broaching has been applied to a diversity of operations including the machining of connecting rods, knee action forgings and parts, roughing of gear sectors, transmission parts, etc. One of the most dramatic applications is that of the broaching lathe which finishes crankshaft journals and cheeks from the rough forging to the final finish, at a rate of 2½ times faster than has been possible heretofore.

Give Engineers Responsibilities

blocks, aiding materially in weight reduction of large engines.

3. The art of heavy-duty welding and flame cutting has made it possible to fabricate large engine structures of low cost, light-weight structural steel, as in the case of the Winton Diesel for railroad use.

4. Shot-welding, a development of the Budd organization, has made it practical to build light-weight structures of high tensile stainless steel materials.

5. Utilization of surface broaching through the cooperation of the engineer and the tool expert has not only cut costs to the bone, but has simplified some burdensome operations.

While the automotive industry as a whole has been quick to adopt the new engineering materials as they have become available, only certain elements in the industry have been conspicuous in their adoption of new processes where the change involves much capital investment. This is not entirely a symptom of depression conditions; it is much more fundamental.

In my opinion, the equipment problem is complicated by many factors, including lack of capital for machinery purchases, unwillingness to take capital from one source and transfer it to the factory budget, lack of understanding of the factory problems on the part of management, obsolete depreciation accounting methods, and occasionally lack of appreciation of the new developments, primarily by engineers and secondarily by factory management.

Production Methods Vary

In approaching the equipment problem, it is well to recognize that automotive production methods vary radically according to the function of the organization. Not all automotive production is mass production as we apply that term to the manufacture of the Ford, Plymouth or Chevrolet. Some of the largest parts makers catering to the big car producers are, in fact, glorified jobbing shops, since their output is based upon many small lots subject to frequent style changes.

Up to the present time the general purpose machine has predominated in the shops of the majority of parts makers and truck plants. And here, too, there is coming a realization that

the unit type machine of the right design is the next move if these producers are to have the benefits of the latest wrinkles in cost-reducing methods.

The unit type machine seems to hold the greatest promise of improvement in manufacturing methods in most plants of any reasonable capacity. The investment in this type of equipment is higher than for general purpose machines, but there is a prospect of greater returns on the investment, while the useful life is practically the same. In fact, the biggest advantage of the unit type machine is that it can be readily converted to another kind of job without much additional expense—about 25 per cent usually.

Short Cuts Have Reduced Costs

Apart from the advantages gained from the use of cost-reducing equipment, automotive manufacturers have developed some really ingenious short cuts in an effort to reduce the cost of tooling new models. An example of this is the design of interchangeable dies for heavy body stampings. Thus the Budd organization was enabled to produce an all-steel body design for the entire Studebaker line, including the more or less low-volume models, through the use of interchangeable die sections, as well as a design which permitted some interchangeability of parts. The same idea was carried out in building the Chrysler Airflow bodies, the back panel being interchangeable on all body styles including the DeSoto.

This sort of program implies a planning ahead by the engineering department. In the ideal sense the engineer should be able to plan ahead several years and develop a tooling program which will make it possible to produce new body lines without scrapping more than a nominal portion of the investment in tooling.

The first example of a complete unit type installation featuring flexibility as its essential element is the set-up for building the White Pancake engine, described in *Automotive Industries*, Oct. 20, 1934.

The distinction of being the only newly built automobile plant in this country goes to the Packard 120, built to sell at \$980 f.o.b. From the point of view of this particular discussion, the

interesting thing about this plant is the cylinder block line, which incorporates a most unusual technique.

This entire line was tooled by Ingersoll Milling Machine Co., which designed, in cooperation with Packard engineers, an entirely new line of equipment embodying the versatile Power-Pack power unit. Apart from producing the block in the desired quantities at the lowest cost known in the industry, the machine line exhibits probably the first instance of styling in production equipment.

Here is an epoch-making development. It is possible to equip a new line even for moderate volume with machinery of single-purpose character, so far as production economy is concerned, and yet the same machinery can be used for an entirely different set-up. Going deeper than that, we find that the management of the company adopted this type of equipment because, through its adaptability, the rate of amortization of the entire investment could be made unusually small by spreading it over a period of years, as with general purpose equipment, whereas it has been the practice to amortize the whole investment over a season or over a single model. This is the biggest single factor in holding down the cost of this car.

Some Management Problems

One of the large problems facing production men and engineers is the establishment of a method of specifying and standardizing surface finish, thus to banish for all time the discrepancy that exists between the designer's idea of what finish he wants and the way in which it is produced by the factory. A number of schemes have been proposed, but the solution still is some way off and will be up in the air until someone takes aggressive action.

Parts makers and others whose production involves scheduling in large or small lots rather than a continuous flow of the same part, should consider seriously the several excellent methods proposed for establishing economic lot sizes. These methods enable the planning department to estimate the best lot size consistent with lowest overall cost, including interest on whatever portion of the lots may be kept in storage. It is important to note that the practical application of economic lot size theory shows that the smallest lot is not necessarily the lowest in cost; also that reasonable variations about the theoretical economic lot size make no appreciable difference in cost.

Cylinder Events Studied in

by Alfred T. Gregory, M.E., Dr.-Ing.

Wright Aeronautical Corp.*

THE logarithmic diagram lends itself peculiarly to the study of cylinder conditions and to the quick determination of the changes taking place. It owes its advantage for such a study to the nature of its polytropic lines. Any isobaric, isometric, isothermal, adiabatic or other polytropic curve when plotted in logarithmic coordinates of the pressure and volume is a straight line. This follows from the logarithmic form of the polytropic equation,

$$\log P + n \log V = C, \quad (1)$$

where P is the pressure, V the volume, n the polytropic exponent and C a constant. The slope of the line, which determines the value of the exponent n , indicates the nature of the change taking place in the cylinder.

The indicator card when plotted in logarithmic coordinates may not actually be composed of straight lines, but the compression and expansion lines, or portions thereof, are usually substantially straight.

Resolving the diagram into straight lines makes possible the determination of the exponent n , which represents the average value for a number of points. A more accurate determination can be made by this means than by finding the exponent at an individual point, since the method is less subject to errors in the card and to errors in making the determination. Deviations of the curve from the polytropic are readily seen, which facilitates the determination of

*Paper presented at the annual meeting of the S. A. E. at Detroit. Slightly condensed.

valve and combustion events.

Constant-temperature lines in the logarithmic diagram are 45-deg. lines. Obviously, the upper one of a number of isothermal lines in any diagram represents the highest temperature. These facts make the determination of the point of maximum cylinder temperature a very simple process. Once the indicator card has been plotted in logarithmic coordinates, it is necessary only to draw a 45-deg. line tangent to the expansion line. The point of tangency will be the point of maximum cylinder temperature.

Fig. 1 shows the logarithmic diagram of a Hill four-cycle Diesel engine operating at 800 r.p.m. The isothermal line ab has been drawn tangent to the curve at point a , which is therefore the point of maximum cylinder temperature. This temperature can be determined if the temperature of any other point in the cycle be known. For along any constant volume line, which is a straight vertical line, the ratio of the absolute temperatures is equal to the ratio of the absolute pressures.

It is necessary, therefore, simply to extend the maximum temperature isothermal line to a point vertically above the point of known temperature and to determine the ratio of the pressures at those two points. If combustion occurred between the point of known temperature and the maximum-temperature point, the calculated temperature would have to be multiplied by a factor allowing for the increase in volume due to the change in the composition of the charge. Expressed mathematically:

$$aT_2 = T_1(p_2/p_1) \quad (2)$$

where T is the temperature, p the pressure and a the factor for the change in composition. The index 1 refers to the point at which the temperature is known and 2 to the point in which it is desired to know the temperature.

The logarithmic form of equation (2) is:

$$\log T_2 = \log T_1 - \log a + (\log p_2 - \log p_1) \quad (3)$$

Since the sums and differences of logarithms represent distances to be added or subtracted on the logarithmic diagram, this equation shows that it is not necessary to calculate the temperature T_2 , but rather that T_2 can be measured.

Thus, the correction for change in the composition of the charge is made by stepping off the distance $-\log a$ from the point of known temperature. The corrected point so obtained represents the temperature T_1 for the charge having the same composition as that existing in the cylinder at the time maximum temperature is reached. The

term $(\log p_2 - \log p_1)$, which is the distance from the corrected point to the maximum temperature isothermal, is then equal to $(\log T_2 - \log T_1)$.

In Fig. 1 the temperature in point c was known to be 620 deg. F. abs. The distance from c to d was made equal to $-\log a$, where a is 0.90. The distance db is equal to $(\log p_2 - \log p_1)$ in which p_2 is the pressure at point b and p_1 the pressure at point d . As pointed out above, however, the distance db also

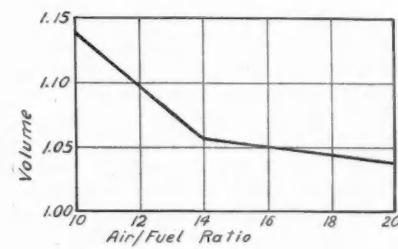


Fig. 2

equals $(\log T_2 - \log T_1)$, T_2 being the temperature at b and T_1 the temperature at d . If a logarithmic scale be used to measure the distance db , placing the value T_1 at point d , the temperature T_2 can be read directly on the scale at point b . The maximum temperature in this diagram was thus found to be 2700 deg. F. abs.

The above procedure suggests a method for measuring the cylinder temperatures throughout the cycle. By drawing a convenient 45-deg. isothermal axis representing a known temperature, the temperature at any point would be represented by the distance from the point to the isothermal axis, the distance being measured along a constant-volume line.

Actually two isothermal axes would be required, one for the compression line and one for the expansion line, to allow for the increase in volume accompanying combustion. The volume increase varies with the air/fuel ratio as illustrated in Fig. 2. The curve indicates that 5 per cent is a fair approximation to volume increase over a considerable range of the air/fuel ratio.

During the actual period of combustion the correction varies with the quantity of fuel burned. The correction may, however, be considered proportional to the weight of the fuel

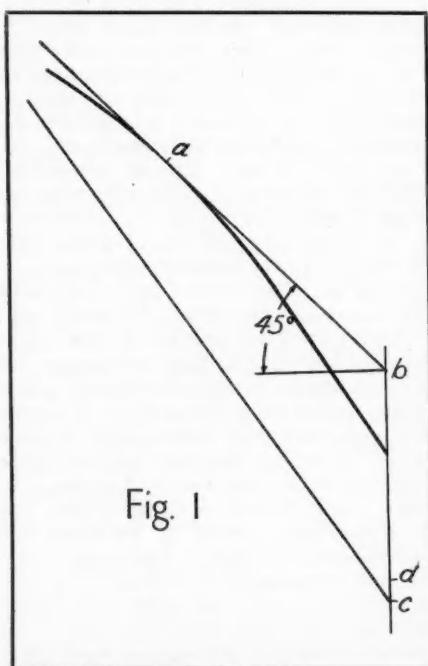


Fig. 1

in the Logarithmic Diagram

burned, thus making the upper isothermal axis bend slightly downward at the combustion end of the stroke to meet the lower axis in the ignition point. The weight of fuel burned may be taken to be proportional to the pressure rise or to the increase in volume.

Probably the most convenient temperature to use for the isothermal axis is $T = 1000$ deg. abs. This value would facilitate the use of a logarithmic scale in reading off the temperatures. The axis may be located, once the suction temperature is known, by laying off $(\log 1000 - \log T_s)$ from the point of closing of the inlet valve, T_s being the suction temperature.

Knowing the temperature in the cylinder, it is possible to ascertain the internal energy of the charge also. Any determination of the internal energy of the mixture of fuel and air, or of the combustion gases, must take into account the change in specific heat with change in temperature and the dissociation of the products of combustion at high temperatures. The specific heats of the constituent gases have been determined for a large temperature range by direct experiment. The amount of energy taken up by the gases as sensible heat can therefore be readily calculated.

Dissociation is influenced by variations in the pressure and by the relative proportions of the gases present. The energy absorbed in this manner can not be readily calculated. From the work done by Tizard and Pye, however, Ricardo has constructed a curve shown in Fig. 3 which gives the total internal energy of the mixture for a wide temperature range.

The curves of Fig. 3 show both the total internal energy of the charge with dissociation and the sensible heat of the charge. While the curves apply to a theoretically-correct mixture of fuel and air, the use of somewhat leaner or richer mixtures does not affect the values appreciably. The heat units are given in ft-lb./std. cu. in. Temperatures are given in deg. F. abs., since the temperatures measured in the logarithmic diagram are absolute temperatures. Zero energy is taken at 572 deg. abs. (212 deg. F.).

Once the temperature in the cylinder is known the internal energy of the charge can be determined by reference to these curves. It is possible also to determine the energy of dissociation and to correct the cylinder temperatures measured in the logarithmic diagram for dissociation.

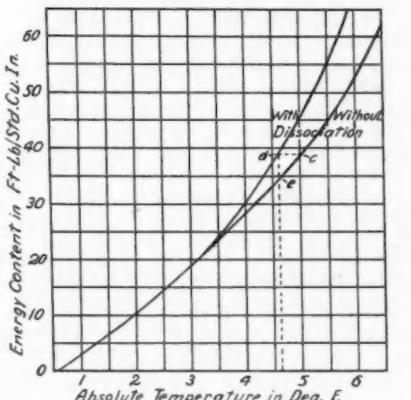
Suppose the temperature as measured to have been 5000 deg. With no dissociation the energy of the charge would be given by point c on the curve of sensible heat in Fig. 3. This energy —39.4 ft-lb./std. cu. in.—would then correspond to the total internal energy of the charge.

But if dissociation occurred and the same amount of energy were put into the charge, the total internal energy would be represented by point d on the curve of total internal energy. The actual temperature would then be $5000 - 420 = 4580$ deg. The energy absorbed by the dissociated products is given by de and amounts to 4.2 ft-lb./std. cu. in. The sensible heat of the charge is therefore reduced to 35.2 ft-lb./std. cu. in. by the dissociation.

Analysis of Indicator Cards

Knowledge of the temperatures and internal energies throughout the cycle makes possible complete study of the events taking place within the cylinder. In conducting this study of the indicator card an ideal cycle has been set up approximating closely the actual card. This procedure greatly facilitated the analysis and gave results that appear reasonable.

Fig. 4 shows an indicator card of an Hispano-Suiza engine running at 1200 r.p.m. at an altitude of 25,000 ft.,



The temperature scale is in units of 1000 deg.

Fig. 3

which has been plotted in logarithmic coordinates*. The valve and combustion events are readily seen as the points of departure of the curve from the polytropic compression and expansion lines.

The first step in the analysis of the card was to estimate the suction temperature, which was done as follows:

Pressure of residual gases at end of exhaust stroke 5.4 lb./sq. in.
Assumed temperature of residual gases... 1200 deg. F. abs.
Volume of residual

*See Schweitzer: The Tangent Method of Analysis for Indicator Cards of Internal Combustion Engines. The Pennsylvania State College Engineering Experiment Station Bulletin No. 35.

gases (in terms of compression ratio)	1
Volume of residual gases at standard temperature and pressure	
Pressure of fresh charge at closing of intake valve	0.15
Temperature of air outside cylinder ..	5.4 lb./sq. in.
Assumed temperature rise due to contact with walls and intake valve	470 deg. F. abs.
Temperature drop due to evaporation of fuel	100 deg. F.
Temperature of fresh charge inside cylinder	40 deg. F.
Volume of fresh charge at closing of intake valve....	530 deg. F. abs.
Volume of fresh charge at standard temperature and pressure	3.89
Total volume of residual gases and fresh charge at standard temperature and pressure	1.32
Suction temperature	1.47
$4.89 \times \frac{5.4}{1.47} \times 492$	600 deg. F. abs.

The temperature of the residual gases can easily be measured in the logarithmic diagram once the isothermal axis has been drawn. In estimating the suction temperature, the residual gas temperature is first assumed and then checked by measurement. If the measured value does not agree with the assumed temperature a recalculation may be necessary.

The temperature rise attributed to the transfer of heat to the charge from the cylinder walls and intake valve during the suction stroke was assumed from figures given by Ricardo, who estimated the temperature rise from this cause to be between 95 deg. and 155 deg. With the low operating conditions of this test the heat absorbed was taken to be relatively small.

The isothermal axis for compression was drawn by first laying-off the distance ($\log 1000 - \log 600$) above the point of closing of the inlet valve. The volume increase during combustion was taken to be 6 per cent, so that the isothermal axis for expansion was drawn a distance $-\log 0.933$ or $+\log 1.06$ above the axis for compression.

In order to check the assumption of 1200 deg. as the temperature of the residual gases, the expansion line in Fig. 4 was extended to the point f , in which point the pressure of the charge was 5.4 lb./sq. in. and the volume 14.1

cu. in. Likewise, the isothermal axis for expansion was extended to the volume 14.1 cu. in. The temperature of the residual gases was then read on the scale at the point *f* and found to be 1550 deg.

Recalculating the suction temperature, using 1500 deg. as the temperature of the residual gases instead of 1200 deg., resulted in raising the suction temperature to 610 deg. The isothermal axes were then redrawn and the temperature of the residual gases measured again and found to be 1520 deg.

The suction temperature so estimated is probably within about 5 per cent of the correct value. Consequently the temperatures measured in the diagram will also be accurate to within about 5 per cent.

The maximum-temperature isothermal was drawn tangent to the expansion line at point *e*. Measurement shows this temperature to have been 3300 deg. Some dissociation occurred, however, which reduced the temperature by 30 deg., thus giving 3270 deg. as the maximum temperature of the cycle.

The heat input to the charge, neglecting losses, was determined to be 21.5 ft-lb./std. cu. in. by taking the difference in the internal energies at points *a* and *b*.

The combustion efficiency may be defined as the ratio of the heat supplied to the charge to the heat contained in the fuel supplied to the charge. If the combustion efficiency be taken to be 65 per cent in this instance, the actual heat supplied in the fuel was 33.1 ft-lb./std. cu. in.

Similarly, the sensible heat still contained in the combustion gases at the end of the expansion stroke was found by taking the drop in the internal energy of the charge between the points *c* and *d*. This heat was found to be 10 ft-lb./st. cu. in. or 30.2 per cent of the heat input.

The work done on the piston is given by the equation:

$$W = \frac{P_1 V_1 - P_2 V_2}{n - 1} \quad (4)$$

where W is the work done, P is the pressure of the charge, V the cylinder volume, and n the exponent for the curve between the points indicated by the indices 1 and 2.

The work done during the expansion stroke was computed as follows:

$$W = \frac{P_b V_b - P_c V_c}{n - 1}$$

$$= \frac{170.1 - (16.8 \times 5.6)}{1.345 - 1} \times \frac{1}{12} \times \frac{1}{1.45}$$

$$= 12.4 \text{ ft-lb./std. cu. in.}$$

In this computation the cylinder volume in cu. in. has been expressed in terms of the compression ratio. Dividing by 12 converts the units obtained from in-lb. into ft-lb. The term 1.45 is the number of standard cu. in. of charge in the cylinder in terms of the compression ratio.

The drop in the internal energy of the charge during expansion is given by the difference in the internal energies at the points *b* and *c* and was found to be 15 ft-lb./std. cu. in.

The heat loss to the cylinder walls during the expansion stroke is the difference between the drop in the internal energy and the actual work done on the piston. This loss amounted to

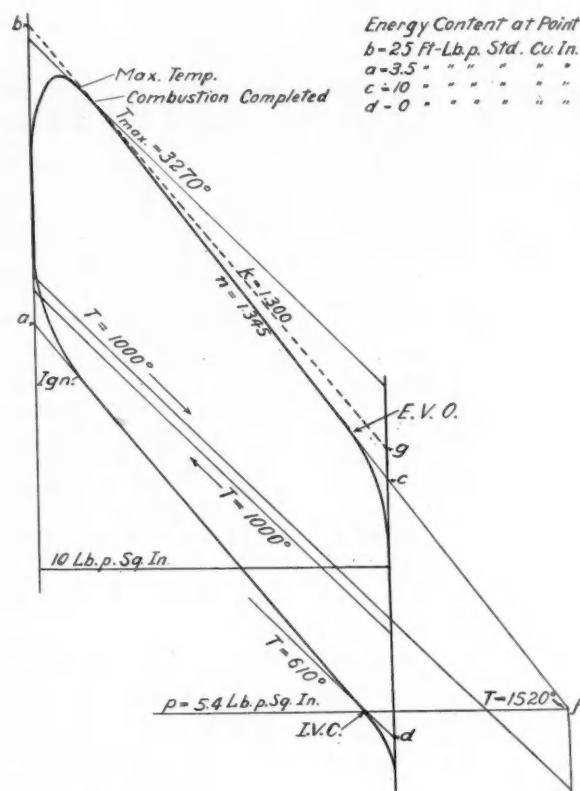


Fig. 4

2.6 ft-lb./std. cu. in. which is 7.9 percent of the heat input in the fuel.

Had there been no heat loss to the cylinder walls during the stroke the expansion would have been adiabatic, as shown by the dash line *bg*. The adiabatic line, which has an exponent of 1.300, was found by determining the polytropic line starting from the point *b* for which the drop in the internal energy of the charge was equal to the work done on the piston.

For the expansion at 1.300 the drop in the internal energy and the work done would each be 12.6 ft-lb./std. cu. in.

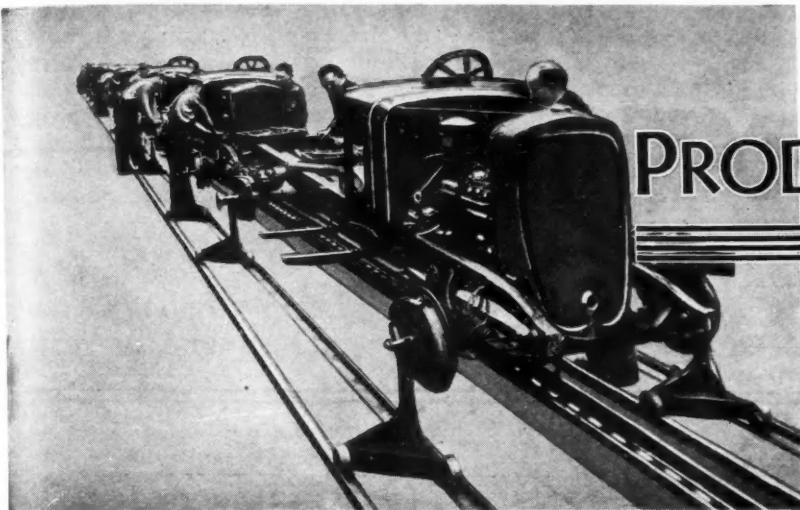
Since the work done with heat loss to the cylinder walls was 12.4 ft-lb./std. cu. in., the gain in power by the elimination of this loss is 0.2 ft-lb./std. cu. in., or only 2.1 per cent of the power output of the engine. At the same time the heat contained in the exhaust would be increased by 2.4 ft-lb./std. cu. in., or an increase from 30.2 to 37.4 per cent of the heat in the fuel.

(The paper also contained analyses of diagrams from a supercharged Cyclone engine and an air-injection Diesel engine, which are omitted here—Editor.)

Running Lamp Load for 1935 Passenger Cars

(Courtesy General Electric Co.)

Auburn 851	12	Hudson 6 and 8	11.1
Auburn 653	10.3	Lafayette	9.6
Buick 40	10.2	LaSalle	11.6
Buick 50-60-90	11.4	Lincoln	10.7
Cadillac	11.6	Nash	10.1
Chevrolet	10.1	Oldsmobile	10.6
Chrysler — Airstream and Airflow C-1	10.6	Packard	12.1
Chrysler Airffow C-2 and C-3	11.2	Packard 120	10.8
DeSoto—Airstream	10.6	Pierce Arrow	11.7
DeSoto—Airflow	10.2	Plymouth	9.9
Dodge	9.6	Pontiac	9.2
Ford—Standard	9.6	Reo	9.7
Ford—Deluxe	9.6	Studebaker	10.1
Graham	10.7	Terraplane G	9.6
		Terraplane GU	10.1



PRODUCTION LINES

Top Lube

A pioneer of the industry, and one who has developed a successful business in top cylinder lubrication, told us how he happened to think of top cylinder lubes and break-in oil. It goes 'way back to the days when he was developing carburetors for some of the aristocrats of the auto business. Cars by the carload were being shipped from the Montreal plant, also in the U. S. consigned to Minneapolis. And they were coming back, fast, with scored cylinders because the crankcase lube would not flow at subzero temperatures. In Canada this man found a fine, light oil that flowed at 'way below zero. For safety in this country, he used a stick of fine lard oil. Before the cars were shipped a little chunk of the stick was broken off into each spark plug hole. As the engine was started at its destination the lard melted and flowed down the cylinder wall. This early but successful experience led to the development of engine protection through the use of a unique break-in oil and top cylinder lube.

Induced Heat

Out in Detroit a live laboratory has developed a method of rapid enameling that just beats all when it's fully tried commercially. The idea is to pass sheet metal parts through a dip tank, subjecting the metal to a high-frequency induced current which heats the metal and sets the finish before it leaves the tank.

Lube Economy

The Houghton Line for February-March has a pointed discussion on

the economy of lubrication surveys for the metal cutting plant. Too many kinds of lubricants are in use, most of them inappropriate for the job. Moreover, where many types are used the oilers occasionally take the nearest one when they are in a hurry. Result—waste, needless maintenance expense, inefficiency. The right kind of lubrication survey will simplify the procedure, eliminate waste, cut down the variety of lubes to a minimum. This isn't theory, it's an accomplished fact, as many large organizations will attest.

K-Monel

An aluminum-monel metal—K Monel—was recently described by a metallurgist of the International Nickel Co. It combines the strength and hardness of alloy steels with exceptional resistance to heat and corrosion. Four hardness grades are available giving a range of tensile strength from 120,000 to 160,000 lb. per sq. in. What its place will be in automotive design is still to be determined.

About Paint

Got to hand it to Sherwin-Wilkins for the unusual spiral-backed book on "Plant Conditioning." It talks about a vital matter—the importance of paint and color in the industrial plant. Gone are the days of drab, dingy walls and machines. Management knows that paint and color pay profits and some of the leaders of this industry are cashing in on this knowledge. But let this booklet tell you the story—ask us for a copy.

Wonder Land

It was a rather thrilling experience to go through the scientific educational exhibit at G. M. Research. Here is an amazing array of apparatus illustrating in simple fashion some of the most complex phenomena known to physicists—sound, light, dynamic balance, vibration—and the like. Some of the exhibits are old, some new, most have been shown at the Chicago Century of Progress, but they're all assembled here as a stimulating feast. One of the most interesting features of the equipment is the use of neon lamps and stroboscopic light. For example, there is the chassis used to demonstrate the effects of balance and unbalance of units. Small lamps are mounted at critical points, on reeds, and when unbalance occurs, how these lamps show it. We believe that engineers as much as the public can enjoy a demonstration of fundamentals and perhaps go away with a better impression of the mechanism of some of the things that they can analyze mathematically.

Profitable Use

One of the most interesting tool handbooks we have seen in many a day is the new 36-page booklet just issued by Carboloy. It's appropriately titled, "The Profitable Use of Carboloy Tools." It gives many close-up views of operations tooled with Carboloy, information concerning applications as well as recommendations of grades for various types of materials. Then, too, there is a section dealing with the manufacture of Carboloy grades and the control methods employed. We can get you a copy, pronto.—J. G.



The Forum —

Improved Lighting Equipment

Editor, AUTOMOTIVE INDUSTRIES:

I have been much interested in the article "Controlling Distribution of Non-Reflected Headlamp Rays Gives Better Road Lighting," by A. Y. Dodge, which appeared in *Automotive Industries* of Dec. 8.

Appearing at this time, the article indicates an apparent renewal of interest in this subject, and it is of special interest to me in view of the arrival of fixed-focus bulbs and of the new types of lamp as used on several cars that came out in 1933 and 1934, particularly lamps having a V-shaped lens, the side view of the center line of the V being slightly convex or swinging outward at the bottom. The car in question is the Chrysler CO-6 1933 model.

With my previous car, a Chrysler Model 75, I could get very satisfac-

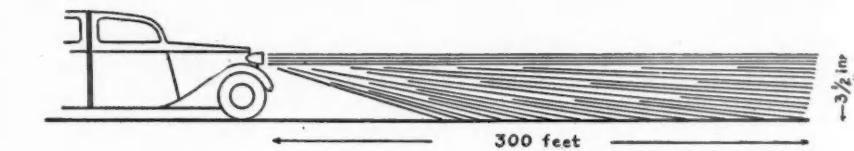


Fig. 1—High beams for distance and to illuminate road between car and range of bright light

sufficient definition to be safe when approaching a parked car, stock, pedestrians nor even to locate rough spots or holes in the road. In this section of the country, where we have plenty of mountains, curves and various kinds of road, we urgently need a flood of illumination to take care of the space between the car

eliminating all but a small portion of the ascending rays in angle C and a spread of light to get ample side illumination for signs and curves, on both the high and low beam, would be very desirable and seems possible of accomplishment. I have attached two sketches, one showing approximately the present patterns obtainable and one showing the most desirable.

In my opinion, when cars parked on highways or pedestrians are struck, it is due to poor lights, one of the reasons being that the bright spots in the lighted area are so strikingly different from the remainder that the eye is unavoidably drawn into the bright area and the individual must force himself to look into the dimly lighted regions to see objects he may be approaching. This being an unnatural thing to do, it is not ordinarily done, or if it is done, it is at the cost of considerable effort, with resulting strain and ultimate fatigue.

Personally, I would much prefer to see manufacturers retain some

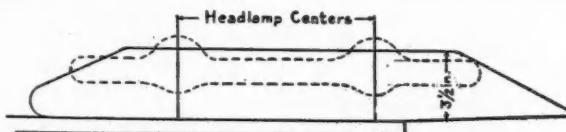


Fig. 2—To show area illuminated on high beam and to right side including as much of right of way as possible

tory illumination, except when driving in a fog—a condition which was very well covered in the article referred to above. With the present lamps I can get a reasonably satisfactory dimmer light, but when the high beam is switched on I find there is not sufficient illumination between the car and the distant bright beam, the space in angle D, Fig. 1.

It would seem from my observation of several makes of lamps which have been standard equipment in the past two years, that an attempt has been made to favor the approaching driver, which is, of course, desirable; but the result has been that the driver has been "short changed," in that he cannot see the road with

and the brighter area of the present lights, both when using the dimmers (low beams) and when running on the higher beams.

A light having the general characteristics of that shown in Fig. 3,

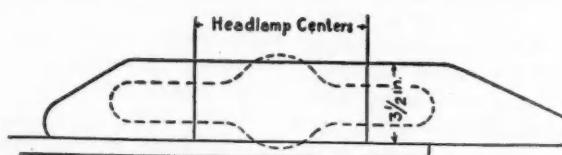


Fig. 3—To show same width and height but within range of low beams or perhaps 75' to 100'

Note—Dotted lines show approximate pattern of present lamps.

type of adjustable-focus light socket so that the pattern of light could be corrected within certain limits. Today we are driving at safe car speeds that are much higher than the highest safe speeds of two years ago. This is partly due to safer roads, and partly to greater stabil-

ity or roadability of our equipment and, of course, better performance generally of the cars, but the fact remains that our lighting equipment in many cases has not kept pace with car speed.

L. O. STRATTON,
Denver, Colo.

Detroit Basing Would Up Prices in Nearby Cities

(Continued from page 404)

base price, the result will be a price of \$1.97½ at Detroit and a price of \$2.05½, on a Detroit base, at Toledo. The steel in question would then be not, as before, 3½ cents per 100 lb. less at Detroit than at Toledo, but 8 cents per 100 lb.

The effect on Toledo buyers of steel, manufacturers, fabricators, distributors, many of them small enterprises, would be substantial and serious, according to NRA.

"They will, if heard, perhaps be able to make a persuasive and reasonable statement in favor of an opportunity at least to adjust their plans, while changes which may be required in the interests of ultimate consumers are being gradually introduced," the report states.

This obviously brings up an inevitable and big problem from changes in the present system, regardless of their desirability or lack of it. It changes the relationship in prices as between competitive buyers and no doubt will develop as many objections from them as from the steel industry itself. It is for this reason that automobile makers outside of the Detroit area have opposed making Detroit a steel basing point.

Murray Bond Extension Plan Now Operative

The plan for extension of the Murray Corp. of America's first mortgage 6½ per cent bonds which matured Dec. 1, 1934, until Dec. 1, 1942, has been declared operative. There are \$1,750,000 of the bonds outstanding of an original issue of \$4,000,000 offered in 1924.

Pontiac Adds Cabriolets

Pontiac has announced the addition of a cabriolet to the DeLuxe six and straight eight lines listing at \$775 and \$840 respectively. Seats are upholstered either in genuine leather or a patterned flat finish wool cloth with the rumble seat in leather. Luggage space is provided at the rear of the front seats, which are split and can be tilted forward. A concealed spare tire or two extra wheels carried in fender wells are optional.

To Sell Willys-Morrow Equipment at Auction

The machinery and equipment of the Willys-Morrow Co., Elmira, N. Y., and a subsidiary of the Willys-Overland Co., will

be sold at public auction by order of the U. S. District Court, according to F. R. Shore, president of Industrial Plants Corp., whom the court appointed to conduct the sale. The sale will start April 2 and continue until April 6. The purpose of the sale is to turn machinery and equipment into cash as a step in reorganization activities of Willys-Overland now in progress.

Lavine in Replacement Field With New Gear

Lavine Gear Co., Milwaukee, is entering the automotive replacement field with its recently perfected "Ball-Drive" steering gear. For the present these units will be built only for Ford passenger car replacement, but units for other makes are to be developed, according to Ben W. Twyman, vice-president and general manager. Resale prices, he said, are in the lowest bracket.

Borg-Warner Corp.

The Borg-Warner Corp. reports a net profit of \$3,750,576 for 1934, which compares with \$1,196,270 for 1933. The company reported its current position as of Dec. 31 to be:

	1934	1933
Current assets	\$1,014,932	\$957,447
Current liabilities	276,128	360,789
Working capital	738,804	596,658

Hercules Motor Corp.

The Hercules Motor Corp. has reported a net profit for 1934 of \$214,506, which compares with a net profit of \$76,515 for the previous year.

Kelsey-Hayes Wheel

After all charges the Kelsey-Hayes Wheel Co. reports a net profit of \$326,392 for 1934, which compares with a net loss of \$696,707 for the period of Feb. 9 to Dec. 31, 1933.

Timken Detroit Axle

Timken Detroit Axle Co. reports a net profit for 1934 of \$426,125, which compares with a net loss of \$1,256,869 in 1933.

Autocar Co.

Net loss of \$139,741 for 1934 against a net loss of \$317,219 for 1933 has been reported by the Autocar Co.

Reo Motor Car

Reo Motor Car Co. reports for 1934 a net loss of \$958,341, which compares with net loss for 1933 of \$2,587,654.

American Rolls-Royce Successor Liquidating

SPRINGFIELD, Mass.—Springfield Manufacturing Corp., formerly Rolls-Royce of America, Inc., is liquidating its inventories, and until a satisfactory plan for continuation of the business is worked out is restricting its operations, pursuant to the advice of the bondholders' protective committee to liquidate the business promptly, President John S. Inskip says in his annual report to the shareholders, of date March 13, made public today. The consolidated financial statement of this company and its subsidiary, Brewster & Co., Inc., shows loss for 1934 of \$252,217, and a deficit on Dec. 31, 1934, of \$3,187,564. Continued annual losses and the persistence of the depression led to the bondholders' decision, Mr. Inskip says.

Allied Products Corp.

The Allied Products Corp. reports a net profit of \$95,561 for 1934 after interest, depreciation, taxes, etc., which compares with a net loss of \$36,165 in 1933.

Aluminum Industries

Aluminum Industries, Inc., reports a net profit of \$69,661 for 1934, which compares with \$100,208 for the previous year. As of Dec. 31 the company's current position was:

	1934	1933
Current assets	\$1,014,932	\$957,447
Current liabilities	276,128	360,789
Working capital	738,804	596,658

Clark Equipment Co.

The Clark Equipment Co. reports a net profit of \$192,000 for 1934, which contrasts with a net loss of \$108,126 in 1933.

Bosch Corp.

A net profit of \$50,101 for 1934 is reported by the United American Bosch Corp. This profit compares with a net loss of \$10,666 in 1933.

Timken Roller Bearing

The Timken Roller Bearing Co. reports a net profit of \$3,486,056 for 1934, which compares with \$2,172,850 for 1933. As of Dec. 31 the company's current position was:

	1934	1933
Current assets	\$26,131,216	\$22,828,788
Current liabilities ...	1,673,981	1,572,149
Working capital	24,457,235	21,256,639

Marlin-Rockwell Corp.

The Marlin-Rockwell Corp. reports a net profit of \$538,258 for 1934, which compares with \$110,535 net profit in the previous year.

Motor Products Corp.

The Motor Products Corp. reports a net profit of \$135,385 in 1934, which contrasts with a net loss of \$216,752 in 1933.

Murray Corp.

The Murray Corp. of America reports a net loss for 1934 of \$798,363, compared with a net loss of \$792,851 in 1933.

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

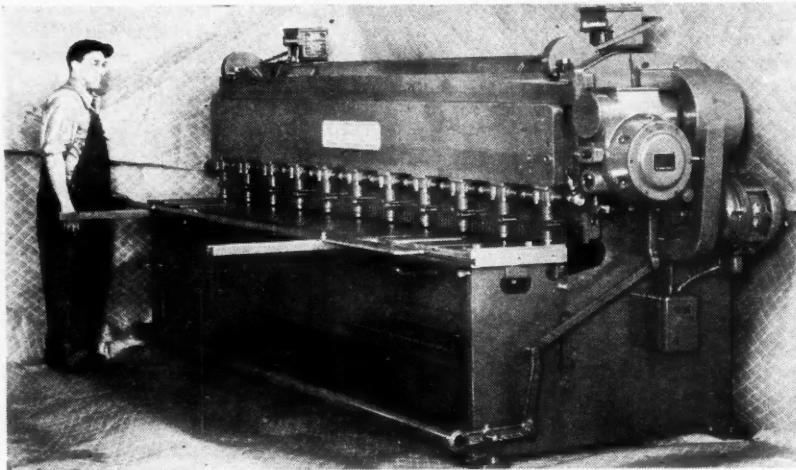
Cincinnati Has Smaller Shears

The Cincinnati Shaper Company, Cincinnati, Ohio, has recently added to their line of all-steel shears a smaller series with capacity for shearing 10-gage mild steel in 8, 10 and 12-ft. lengths; illustration shows the 10-ft. shear.

General design is the same as in the heavy all-steel shears manufactured by

der oil. In addition there is a friction slip or clutch for the flywheel rim as overload protection. The characteristic features of this shear are the low rake of the knives, 5/16 in. to the foot; four-edge solid knives, and a speed of 60 strokes a minute.

This shear is regularly furnished with a 6-in. throat in the housings. The illustration shows a slitting gage by which long sheets can be cut on a short shear in two or more operations



this company; the main frame, table and crosshead being cut from heavy rolled steel plate; hydraulic hold-downs with plungers spaced at 12-in. centers, developing a pressure of approximately 2000 lb. each; the five-jaw clutch is totally enclosed and runs un-

as accurately as with a single cut. With this equipment it is impossible to see where the successive cuts start.

Extreme accuracy with high production, low maintenance cost and longer knife life are the advantages claimed for this equipment.

New Spectograph by Bausch & Lomb

Bausch & Lomb Optical Co., Rochester, N. Y., has recently announced the production of a new spectrograph. This is the Small Littrow Spectrograph utilizing the same principle to effect increased dispersion as the most expensive B & L spectrograph. It is a quality instrument and its precise construction makes it an excellent tool for education and industry.

The range covered by the Small Littrow Spectrograph is from 2100A° to 7000A°. The linear dispersion between these lines is approximately 150 millimeters. The length of the individual lines on the photographic plate is 3 millimeters. The entire range is covered by a single spectrogram.

The slit is a radical departure from customary design. Four standard fixed slits are provided of two, five, ten, and twenty microns width, cut in a properly protected silver coating deposited on a single quartz slide.

The optical system is of crystal quartz. The design of the system is of the Littrow "auto-collimating" type in which a prism with a reflecting back is used, and a single lens serves both as collimator and camera lens. The light entering the slit is rendered parallel by the lens and is refracted upon entering the prism. The metallic coating on the back of the prism reflects it along a path nearly parallel to the entering beam. It is again refracted upon leaving the prism and is focused as a dispersed spectrum on the plate by the same lens that collimates the entering

light. For a given overall length of the instrument, almost twice the usual focal length and dispersion are allowed by this design.

Bearing Covers

A line of cast-iron housing covers for ball and roller bearings is being offered to users of such bearings by the Bearing Appliance Co. of Ardmore, Pa. These covers are finished and ready for use. They include both closed covers in various styles and "open" covers using a variety of closing methods for shaft extensions. Among the latter are designs closing the shaft opening with felts, with flingers, and with standard makes of leather or composition oil seals. Many of the parts are provided with lubricating and cleaning openings, which makes it unnecessary for the user to provide such openings in the main housings. For bearings of the same diameter the fastenings of the covers have been standardized, and either round or lug type flanges are offered.

Under the Hood Inverse Oiler

The Emerol Manufacturing Co., 242 West Sixty-ninth Street, New York, N. Y., maker of Marvel Mystery oil, has just placed on the market the Model T Marvel Inverse Oiler for under-the-hood installation. This unit has a capacity of two quarts, and, like the Model O (instrument board unit), it increases and decreases the flow of oil inversely with vacuum.

The adapter on the head of the unit has a calibrated adjusting screw by means of which it is possible to adjust the flow of oil, in drops per minute, to any desired value. The adjustment is made for flow in drops per minute at a manifold vacuum of 5½ in., which is approximately the depression under

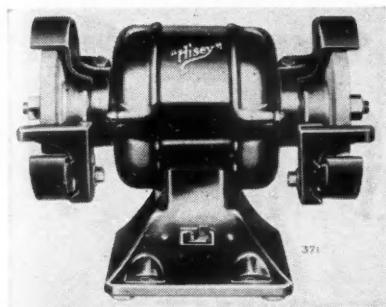


load conditions; the flow decreases at closed throttle when the vacuum is much higher.

This adjustment is tamper-proof, since the cap is threaded on the adapter and drilled for a sealing wire. This feature, obviously, is of great value to fleet operators in the interest of economical usage of oil. Dash installation is readily made, since the body of the oiler can be rotated in any position.

Hisey Wolf Bench Grinder

The Hisey-Wolf Machine Company, Cincinnati, Ohio, has added a line of 6-in. wheel bench and floor grinders of $\frac{1}{4}$ hp. capacity. These tools are designed for light and miscellaneous jobs

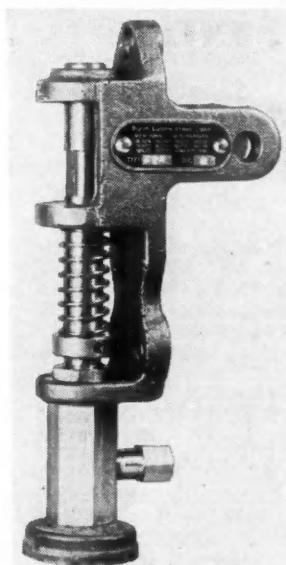


and are available for either A.C. or D.C. supply. A feature of these grinders is the ball-bearing mounting with dust seals.

A pedestal is available as an accessory, affording a mounting height of 39 in. It weighs 65 lb.

Bijur Lubrication for Machine Tools

Bijur central lubrication, which was first developed for automotive vehicles, has been successfully applied to the lubricating systems of the machine



tools used in the automotive industry. According to the Bijur Lubricating Corp., Long Island City, N. Y., the new line of lubricators is available either as automatic units or in the familiar one-shot or manual form. The illustration shows a typical Type G lubricator used for the automatic and continuous lubrication of aprons, saddles, heads, etc.

The Bijur system makes available a large variety of metering fittings of different flow rates to serve the re-

quirements of any combination of bearings. The metering fittings have no moving parts, thus assuring an invariable flow rate. Check valves in the drip plugs keep the lines full of oil at all times and oil of any viscosity may be used.

It is stated that this system has been adopted by many outstanding machine tool builders.

grinder design, including increased power; full-sized ball bearings on armature shaft and wheel spindle; enclosed commutator compartment to protect mechanism and keep out abrasive dust; improved balance; easier handling; im-



"Van Dorn" Portable Electric Grinders

The Van Dorn Electric Tool Company, Towson, Md., has produced a new line of portable electric grinders. The 4, 5 and 6-inch units embody the most advanced principles of portable

proved ventilation to prevent clogging and insure cool motor operation, and adjustable wheel guards for grinding in any position.

Standard voltage, 110; also available for 220 or 250 volts without extra cost. Powerful universal motors operate on either alternating or direct current.

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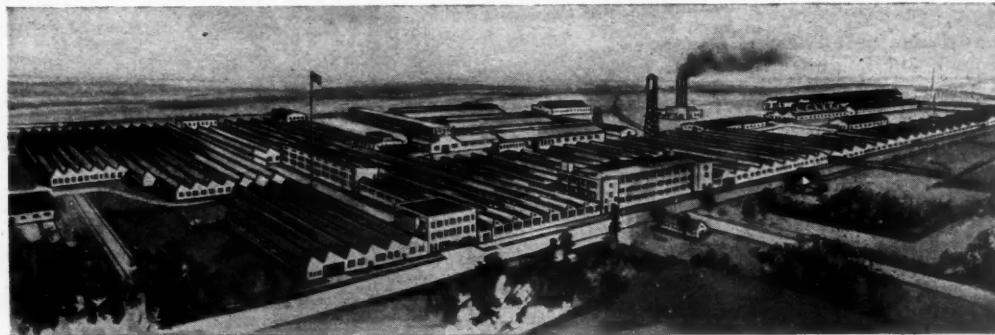
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